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ll and Karl Huemmrich, Editors

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Precipitation

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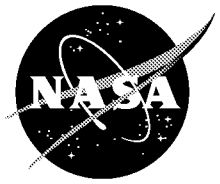

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Karl Huemmrich, Editors

Volume 193

BOREAS TF-2 SSA-OA Tower Flux, Meteorological, and Precipitation Data

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

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BOREAS TF-2 SSA-OA Tower Flux, Meteorological, and Precipitation Data

Harold Neumann, Robert Mickle, Ralf Staebler

Summary

The BOREAS TF-2 team collected energy, carbon dioxide, water vapor, and momentum flux data above the canopy and in profiles through the canopy, along with meteorological data at the BOREAS SSA-OA site. Above-canopy measurements began in early February and ran through mid-September of 1994. Measurements were collected over a longer period of 1994 than most BOREAS flux sites. Daily precipitation data from several gauges were also collected. The data are available in tabular ASCII files.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS TF-02 SSA-OA Tower Flux, Meteorological, and Precipitation Data

1.2 Data Set Introduction

The Tower Flux (TF)-02 team collected heat, carbon dioxide, water vapor, and momentum fluxes along with meteorological data measured from the BOReal Ecosystem-Atmosphere Study (BOREAS) Southern Study Area (SSA) Old Aspen (OA) tower. Measurements were collected at several different heights within and above the forest canopy to produce profiles of several variables, including sensible heat flux, latent heat flux, air density, wind speed and direction, friction velocity, momentum flux, CO_2 concentration and flux, water vapor flux, air temperature, vapor pressure, and dewpoint temperature. Data collection began in early February 1994, making this site the earliest BOREAS flux tower to collect data in 1994.

1.3 Objective/Purpose

The general objective was to study CO_2 and water vapor exchange between the forest and atmosphere at the SSA-OA site. Specific objectives were:

- To measure the fluxes of sensible heat, H_2O and CO_2 above and within the aspen stand throughout the year.
- To obtain from the CO_2 flux data estimates of gross photosynthesis and respiration.
- To determine the contribution of the hazelnut understory to net ecosystem productivity (NEP).
- To determine the effects of environmental factors on stand evapotranspiration and NEP.
- To take part in the development of procedures for scaling up component fluxes to the stand level.
- To study the processes controlling turbulent transfer of H_2O and CO_2 within the stand.
- To take part in the evaluation of methods of estimating nocturnal CO_2 in and above the stand.

1.4 Summary of Parameters

Profiles through the forest canopy of the following variables were measured: latent heat flux, latent heat storage, sensible heat flux, air density, CO_2 flux, CO_2 concentration, CO_2 storage flux, momentum flux, air temperature, wind speed and direction, friction velocity, standard deviation of the vertical wind speed, water vapor flux, and virtual heat flux. Other measurements include net radiation, incident and reflected photosynthetic photon flux density (PPFD), incident shortwave radiation, air pressure, relative humidity, canopy surface temperature, absolute humidity, ozone concentration, and precipitation.

1.5 Discussion

In 1993 and 1994, the TF-01 group measured fluxes under the canopy at the SSA-OA site, while the TF-02 group measured above-canopy fluxes and profiles at that site. In 1996, the TF-01 group moved its equipment to the top of the 39-meter tower to measure above-canopy fluxes; this document describes the TF-02 1994 data collection effort.

The TF-02 group operated an eddy correlation system at the 39-m height. It consisted of a 3-D sonic anemometer (model DAT-310 with model TR-61B probe, Kaijo-Denki, Tokyo, Japan) with a 20-cm path length, a model 6262 Infrared Gas Analyzer (IRGA), and an ozone sensor. Air was drawn at 6.5 l/min down 6-m long heated 3.2-mm inner diameter (i.d.) Bev-a-line sampling tubing, then pumped through the sample cell using two diaphragm pumps (model TD-4X2N, Brailsford Co. Rye, NY) connected in parallel. To prevent condensation, the sampling tubing was heated (2-3 °C above ambient) by passing an electric current through 20-AWG nichrome wire (about 15 ohms resistance) coiled around the exterior of the tubing. Sample cell pressure was approximately atmospheric pressure and the delay time was 1.2 s. The IRGA was operated in differential mode with 320 mmol/mol CO_2 in dry air flowing through the reference cell at 30 cm^3/min. TF-02 also operated 3-D sonic anemometers at 28.6, 18.6, 5.9 (all TR-61B probes), and 0.5 m (miniature probe). A second University of British Columbia (UBC) IRGA unit was used with the 28.6, 5.9, and 0.5 m units during selected periods in 1994 (see P.C. Yang's Ph.D. thesis, 1998).

Other measurements included air temperatures using aspirated platinum resistance thermometers (at 0.8, 2.3, 6.8, 9.9, 13.0, 16.1, 19.2, 22.3, 25.4, 30.1, and 34.6 m), downward total and diffuse solar (model PSP pyranometer, The Eppley Laboratory, Inc., Newport, RI), downward longwave (Eppley model PIR pyrgeometer) and net radiation (Middleton model CN-1 net radiometer), PPFD (LI-COR model 190-SB quantum sensor) above the forest (at 33-m height from the ground), air humidity above (model M1 dewpoint hygrometer with a model D2 sensor, General Eastern Instruments Corp., Watertown, MA) and below (model HMP-35C sensor, Vaisala, Inc., Woburn, MA) the overstory, wind speed and direction above and below the overstory (model 05031 vane propeller anemometer, R.M. Young Co., Traverse City, MI), and infrared surface temperatures of the aspen and hazelnut canopies (model 4000 IR thermometer, Everest Interscience, Inc., Fullerton, CA). Precipitation was measured using a weighing rain gauge (Belfort Instrument Co., Baltimore, MD). In addition, TF-02 operated a CO_2 concentration profile system, consisting of eight levels: 0.8, 2.3, 9.5, 15.7, 18.8, 21.9, 25, and 34.5 m. Air was drawn through heated Dekoron tubing (9.3-mm inner diameter) by a rotary pump and pushed through a LI-COR 6262 IRGA by a small diaphragm pump.

1.6 Related Data Sets

BOREAS TF-01 SSA-OA Soil Characteristics Data
BOREAS TF-01 SSA-OA Tower Flux and Meteorological Data, and Soil Temperature Data
BOREAS TF-01 Understory Flux, Meteorological, and Soil Temperature Data
BOREAS TF-09 SSA-OBS Tower Flux, Meteorological, and Soil Temperature Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

Gerry den Hartog
Atmospheric Environment Service

Harold Neumann
Air Quality Processes Research Division
Atmospheric Environment Service

2.2 Title of Investigation

Boreal Forest Atmosphere Interactions: Exchanges of Energy, Water Vapor and Trace Gases (SSA-OA)

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3. Theory of Measurements

Measurements of the fluxes of momentum, sensible heat, water vapor, and CO_2 were made with the eddy covariance technique. Velocity components, air temperature, water vapor density, and CO_2 concentration in the air were sampled rapidly, and calculations of relevant covariances were performed from these samples to obtain the fluxes. For example, the flux of CO_2 was determined as follows:

$$F_c = \overline{w'c'}$$

where w' is the departure of the vertical velocity component from its mean over the averaging interval, usually 30 minute, and c' is the departure of CO_2 concentration from its mean.

At the overstory level, three rotations in the coordinate transformation are applied to the flux data to make the lateral component (v'), vertical component (w'), and covariance ($\overline{u'v'}$) of the wind vector equal to zero. At the understory level, however, only the mean lateral wind velocity component was rotated to zero under the suspicion that nonzero mean vertical velocities are possible within the trunk space. Webb, Pearman, and Leuning (1980) (WPL) corrections were made to the water vapor and carbon dioxide fluxes measured using the closed-path LI-COR 6262 infrared gas analyzer (IRGA). Broadening correction was done, but not on-line (see Chen et al., 1998, for summary of theory).

4. Equipment

4.1 Sensor/Instrument Description

4.1.1 Collection Environment

Measurements were collected from beginning of the year to mid-September of 1994. Over that time period, temperature conditions from less than -30 °C to over 30 °C were experienced.

4.1.2 Source/Platform

A 37-m walk-up scaffold main tower and a 6-m scaffold tower about 40 m from the main tower. Rain gauges were located in a small clearing 70 m NE of the main tower.

4.1.3 Source/Platform Mission Objectives

The objective of the flux tower was to support instrumentation for the study of the fluxes of CO_2, energy, water vapor, and momentum between the forest and atmosphere at the SSA-OA.

4.1.4 Key Variables

Variables measured using eddy covariance: CO_2 and water vapor fluxes, momentum fluxes, sensible heat fluxes, and latent heat fluxes.

Supporting meteorological variables: net radiation, downward solar radiation, incident and reflected PPFD, wind speed, wind direction, air temperature, and precipitation.

4.1.5 Principles of Operation

A sonic anemometer determines the wind speed by a pair of transducers acting alternately as transmitters and receivers, sending pulses of high-frequency ultrasound between themselves. The 3-D sonic has three pairs of transducers arranged in nonparallel axes.

The LI-COR 6262 CO_2/H_2O analyzer is based on the difference in absorption of infrared radiation passing through two gas sampling cells. The reference cell is used for a gas of known CO_2 or H_2O concentration, and the sample cell is used for a gas of unknown concentration. Infrared radiation is transmitted through both cell paths, and the output of the analyzer is proportional to the difference in absorption between the two.

The principles of operation of most of the supporting instruments can be found in Pearcy et al. (1991) and Fritschen and Gay (1979).

4.1.6 Sensor/Instrument Measurement Geometry

Above-canopy sensors were supported by a vertical triangular mast mounted on top of a 37-m-tall scaffold-type main tower. Air temperature profiles were measured using aspirated resistance bulb thermometers at 0.8, 2.3, 6.8, 9.9, 13.0, 16.1, 19.2, 22.3, 25.4, 30.1, and 34.6 m above ground level. All thermometers were mounted on the main tower except for the 0.8 and 2.3 m heights, which were on a minitower 8 m WSW of the main tower. Vapor pressure and dewpoint profiles were measured using two water vapor instruments connected to the sampling system, a chilled mirror dewpoint hygrometer and an IRGA. Measurements were collected at 0.8, 2.3, 9.9, 16.1, 19.2, 22.3, 25.4, and 34.6 m above ground level, with all sampling locations on the main tower except for 0.8 and 2.3 m heights, which were on the minitower. The same sampling heights were used for the CO_2 concentration profiles. 3-D sonic anemometers were operated at 39.5, 28.6, 18.6, 5.9 (all TR-61B probes), and 0.5 m (miniature probe) to provide profiles of energy, water vapor, and CO_2 fluxes.

Rain gauges were located in a small clearing 70 m NE of the main tower. Wind speed and direction were measured with a vane propeller anemometer mounted on the tower at 39.4 m height. Above-canopy air temperature and relative humidity were measured at 37.3 m height. The atmospheric pressure sensor was located in instrument hut B. Incident shortwave radiation was measured at 39.4 m height, mounted above the SW corner of the tower. Incident PPFD was measured at 38.8 m mounted 1 m out from the SW corner of the tower, and the reflected PPFD was measured at 38.7 m, just below the incident PPFD sensor. The two net radiometers were mounted side-by-side at end of a boom arm 4.5 m to SSW of the SW corner of the tower at 38.5 m height. The IR thermometer measuring canopy surface temperature was mounted at 27.4 m viewing canopy to NNE at an angle of 30°. Above-canopy dewpoint was measured with a dewpoint hygrometer at 39.5 m. Above-canopy CO_2 concentration was measured at 34.6 m. Above-canopy ozone concentration was measured at 37.4 m, and the below canopy ozone concentration was sampled just outside instrument hut B at 3 m.

4.1.7 Manufacturer of Sensor/Instrument

DAT-310 sonic anemometer:
Kaijo-Denki Co., Ltd.
No 19.1 Chrome Kanda-Nishikicho
Chiyoda-Ku
Tokyo 101
Japan

LI-COR LI-6262 IRGA, 190-SB PPFD, and LAI-2000 PCA:
LI-COR, Inc.
P.O. Box 4425/4421
Superior Street
Lincoln, NE 68504
(303) 499-1701
(303) 499-1767 (fax)

KH2O krypton hygrometer:
Campbell Scientific
P.O. Box 551
Logan, UT 84321

CN-1 net radiometer:
Middleton Instruments, Inc.
P.O. Box 442
South Melbourne
Victoria, 3205
Australia

S-1 net radiometer:
Swissteco Instruments Inc.
Stegweg, Eichenwies, CH-94633 OBERRIET SG
Switzerland

PSP pyranometer and PIR pyrgeometer:
The Eppley Laboratory, Inc.
12 Shefield Ave.
P.O. Box 419
Newport, RI 02840
(401) 847-1020
(401) 847-1031 (fax)

05031 vane propeller anemometer:
R.M. Young Co.
Traverse City, MI

Distributor:
Campbell Scientific
P.O. Box 551,
Logan, UT 84321
(801) 753-234
(801) 752-3268

4000 IR thermometer:
Everest Interscience, Inc.
P.O. Box 3640
Fullerton, CA 92634-3640
(714) 992-4461

M1 dewpoint hygrometer (with D2 sensor):
General Eastern Instruments Corp.
Watertown, MA

HMP-35C Vaisala humidity sensor:
Vaisala, Inc.
Woburn, MA

Distributor:
Campbell Scientific
P.O. Box 551
Logan UT 84321
(801) 753-2342
(801) 752-3268 (fax)

CS105 Barometer:
Vaisala, Inc.
Woburn, MA

Distributor:
Campbell Scientific
P.O. Box 551
Logan, UT 84321
(801) 753-2342
(801) 752-3268 (fax)

TE525 Tipping-bucket rain gauge:
Texas Electronics

Distributor:
Campbell Scientific
P.O. Box 551
Logan, UT 84321
(801) 753-2342
(801) 752-3268 (fax)

Weighing rain gauge:
Belfort Instrument Co.
1600 S. Clinton Street
Baltimore, MD 21224

21x, CR10 Data logging system:
Campbell Scientific
P.O. Box 551,
Logan, UT 84321
(801) 753-2342
(801) 752-3268 (fax)

TD-4X2N diaphragm pump:
Brailsford Co.
670 Milton Road
Rye, NY 10580
(914) 967-1820
(914) 967-1836 (fax)

DOA-V191-AA diaphragm pump:
Gast, Inc.
P.O. Box 97
Benton Harbor, MI
(616) 926-6171
(616) 925-8288 (fax)

Bev-a-line tube:
Thermoplastic Processes, Inc.
Sterling NS

Dekoron tubing:
Wirex Controls Ltd.
9446 McLaughlin Road N. Unit #27
Brampton, ON
Canada, L6X 4H9
(905) 459-0742
(905) 450-8216

4.2 Calibration

4.2.1 Specifications

Zeroing and calibration was done manually on the IRGA. Calibration was done using 350 ppm CO_2 cylinders (Medigas) calibrated using AES cylinders and a LI-COR dewpoint generator.

The two net radiometers were intercompared. The comparison yielded NET_RAD_ABV_CNPY_2 = 1.111*NET_RAD_ABV_CNPY_1 for net radiation values greater than 0 and NET_RAD_ABV_CNPY_2 = 1.224*NET_RAD_ABV_CNPY_1 net radiation values less than 0. TF-01 checked net radiometer calibration against a precision pyranometer by shading on 11-Apr-1994 at 17:30 to 18:30 Greenwich Mean Time (GMT); the change in NET_RAD_ABV_CNPY_2 was 3.1% greater than for the standard.

4.2.1.1 Tolerance

The tipping bucket gauge had a resolution of 0.45 mm.

4.2.2 Frequency of Calibration

Not given.

4.2.3 Other Calibration Information

None.

5. Data Acquisition Methods

The overstory eddy correlation system consisted of a 3-D sonic anemometer (model DAT-310 with model TR-61B probe, Kaijo-Denki, Tokyo, Japan) with a 20-cm path length, a model 6262 IRGA, and an ozone sensor. Air was drawn at 6.5 l/min down 6-m-long heated 3.2-mm i.d. Bev-a-line sampling tubing, then pumped through the sample cell using two diaphragm pumps (model TD-4X2N, Brailsford Co. Rye, NY) connected in parallel. To prevent condensation, the sampling tubing was heated (2-3 °C above ambient) by passing an electric current through 20-AWG nichrome wire (about 15 ohms resistance) coiled around the exterior of the tubing. Sample cell pressure was approximately atmospheric pressure, and the delay time was 1.2 s. The IRGA was operated in differential mode with 320 mmol/mol CO_2 in dry air flowing through the reference cell at 30 cm^3/min. All raw data were recorded using PC systems with backup tape drives. Half-hour fluxes were calculated online.

6. Observations

6.1 Data Notes

CO_2 concentration, vapor pressure, and dewpoint profiles were collected from 03-Feb to 19-Sep-1994. Air temperature profiles were collected from 01-Feb to 19-Sep-1994. Daily precipitation data, the total of a 24-hour period ending at 15:00 GMT, were collected from 31-Jan to 19-Sep-1994. Tipping bucket gauge precipitation data were collected from 16-May to 29-Jul-1994.

Above-canopy air temperature, wind speed and direction, relative humidity, dewpoint, incident shortwave radiation, incident PPFD, ozone concentration, and air pressure data begin on 01-Jan-1994. Net radiation begins 04-Feb-1994, reflected PPFD begins 19-July-1994, canopy surface temperature begins 18-Feb-1994, above-canopy CO_2 concentration begins 03-Feb-1994, and below-canopy ozone concentration begins 25-May-1994. All end 19-Sep-1994.

Flux data were collected at the following heights:

- 39.5 m, above canopy;
- 28.6 m, above canopy;
- 18.6 m, within crown space, no water vapor or CO_2 fluxes at this height;
- 5.85 m, above understory;
- 1.8 m, at top of understory, no water vapor or CO_2 fluxes at this height;
- 0.45 m, within understory.

Flux data at 39.5 m were collected from 02-Feb to 19-Sep-1994, at 28.6 m from 12-Feb to 19-Sep-1994, at 18.6 m from 09-Aug to 19-Sep-1994, at 5.85 m from 03-Apr to 19-Sep-1994, at 1.8 m from 19-May to 16-Jun-1994, and at 0.45 m from 16-Jun to 19-Sep-1994. Water vapor and CO_2 flux data at 39.5 m were collected from 02-Feb to 19-Sep-1994, at 28.6 m from 10-Jun to 16-Jun-1994, at 5.85 m from 10-Aug to 22-Aug-1994, and at 0.45 m from 16-Jun to 19-Sep-1994 except for the period from 10-Aug to 22-Aug-1994. Coordinate transforms to set mean v and w wind vectors to zero were applied to the 39.5- and 28.6-m data; for data from the other heights, the coordinate transform applied set only mean v wind vector to zero.

6.2 Field Notes

None.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

All data were collected at the BOREAS SSA-OA site in the Prince Albert National Park (PANP). North American Datum of 1983 (NAD83) coordinates for the site are:

- SSA-OA: latitude 53.62889° N, longitude 106.19779° W, and elevation of 600.63 m.

7.1.2 Spatial Coverage Map

Not applicable.

7.1.3 Spatial Resolution

Although the eddy covariance measurement is made at one point, it is well known that the fluxes measured with this technique can represent fluxes averaged over a relatively large area. An analysis of the upwind land surface area that contributes to a scalar flux measurement, often referred to as "fetch" or "footprint," is crucial in understanding the origins of the flux and any possible influences of spatial heterogeneity. According to Blanken's (1997) results (using Schuepp et al., 1990, model), the cumulative flux at 39 m reached 80% of the total flux at an upwind distance of 1,200 m under neutral conditions, 900 m under typical daytime stability conditions, and 2,700 m under typical nighttime stability conditions. The corresponding values for the 4-m height (above the understory) were 130, 80,

and 300 m. Baldocchi (1997) suggests the latter values are overestimates. From the above results, there was adequate fetch at the OA site because the forest extended for at least 3 km in all directions.

7.1.4 Projection

None.

7.1.5 Grid Description

None.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Different instruments came online at different times, so the periods of available data vary with instruments. CO_2 concentration, vapor pressure, and dewpoint profiles were collected from 03-Feb to 19-Sep-1994. Air temperature profiles were collected from 01-Feb to 19-Sep-1994. Daily precipitation data were collected from 31-Jan to 19-Sep-1994. Tipping bucket gauge precipitation data were collected from 16-May to 29-Jul-1994.

Above-canopy air temperature, wind speed and direction, relative humidity, dewpoint, incident shortwave radiation, incident PPFD, ozone concentration, and air pressure data begin on 01-Jan-1994. Net radiation began 04-Feb-1994, reflected PPFD began 19-Jul-1994, canopy surface temperature began 18-Feb-1994, above-canopy CO_2 concentration began 03-Feb-1994, and below-canopy ozone concentration began 25-May-1994. All end 19-Sep-1994. Note that Saskatchewan Research Council (SRC) (Airborne Fluxes and Meteorology (AFM)-07) operated a MESONET site at the OA (70 m southeast of main tower) through the study period.

Flux data at 39.5 m were collected from 0 2-Feb to 19-Sep-1994, at 28.6 m from 12-Feb to 19-Sep-1994, at 18.6 m from 09-Aug to 19-Sep-1994, at 5.85 m from 03-Apr to 19-Sep-1994, at 1.8 m from 19-May to 16-Jun-1994, and at 0.45 m from 16-Jun to 19-Sep-1994. Water vapor and CO_2 flux data at 39.5 m were collected from 02-Feb to 19-Sep-1994, at 28.6 m from 10-Jun to 16-Jun-1994, at 5.85 m from 10-Aug to 22-Aug-1994, and at 0.45 m from 16-Jun to 19-Sep-1994 except for the period from 10-Aug to 22-Aug-1994.

7.2.2 Temporal Coverage Map

None.

7.2.3 Temporal Resolution

The data reported in the tower flux data are 30-minute statistical mean values. Daily precipitation data are the total of a 24-hour period ending at 15:00 GMT.

7.3 Data Characteristics

7.3.1 Parameter/Variable

The parameters contained in the data files on the CD-ROM are:

TF02_DAILY_PRECIP

Column Name
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
TIP_BUCKET_PRECIP
BELFORT_PRECIP
STANDARD_PRECIP
CRTFCN_CODE
REVISION_DATE

TF02_TOWER_FLUX

Column Name
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
NET_RAD_ABV_CNPY_1
NET_RAD_ABV_CNPY_2
SENSIBLE_HEAT_FLUX_ABV_CNPY
SENSIBLE_HEAT_FLUX_2806CM
SENSIBLE_HEAT_FLUX_585CM
SENSIBLE_HEAT_FLUX_45CM
LATENT_HEAT_FLUX_ABV_CNPY
LATENT_HEAT_FLUX_2806CM
LATENT_HEAT_FLUX_585CM
LATENT_HEAT_FLUX_45CM
AIR_DENSITY_ABV_CNPY
AIR_DENSITY_2806CM
AIR_DENSITY_1860CM
AIR_DENSITY_585CM
AIR_DENSITY_140CM
AIR_DENSITY_45CM
WIND_SPEED_ABV_CNPY
WIND_SPEED_2806CM
WIND_SPEED_1860CM
WIND_SPEED_585CM
WIND_SPEED_140CM
WIND_SPEED_45CM
FRICTION_VEL_ABV_CNPY
FRICTION_VEL_2806CM
FRICTION_VEL_1860CM
FRICTION_VEL_585CM
FRICTION_VEL_140CM
FRICTION_VEL_45CM
MOMENT_FLUX_ABV_CNPY
MOMENT_FLUX_2806CM
MOMENT_FLUX_1860CM
MOMENT_FLUX_585CM
MOMENT_FLUX_140CM
MOMENT_FLUX_45CM
SDEV_W_WIND_SPEED_ABV_CNPY
SDEV_W_WIND_SPEED_2806CM
SDEV_W_WIND_SPEED_1860CM
SDEV_W_WIND_SPEED_585CM
SDEV_W_WIND_SPEED_140CM
SDEV_W_WIND_SPEED_45CM
H2O_FLUX_ABV_CNPY
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H2O_FLUX_585CM
H2O_FLUX_45CM
CO2_FLUX_ABV_CNPY
CO2_FLUX_2806CM
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CO2_FLUX_45CM
STABILITY_INDEX_ABV_CNPY
STABILITY_INDEX_2806CM
STABILITY_INDEX_1860CM
STABILITY_INDEX_585CM
STABILITY_INDEX_140CM
STABILITY_INDEX_45CM
SDEV_WIND_DIR_ABV_CNPY
SDEV_WIND_DIR_2806CM
SDEV_WIND_DIR_1860CM
SDEV_WIND_DIR_585CM
SDEV_WIND_DIR_140CM
SDEV_WIND_DIR_45CM
VIRTUAL_HEAT_FLUX_ABV_CNPY
VIRTUAL_HEAT_FLUX_2806CM
VIRTUAL_HEAT_FLUX_1860CM
VIRTUAL_HEAT_FLUX_585CM
VIRTUAL_HEAT_FLUX_140CM
VIRTUAL_HEAT_FLUX_45CM
SDEV_SONIC_AIR_TEMP_ABV_CNPY
SDEV_SONIC_AIR_TEMP_2806CM
SDEV_SONIC_AIR_TEMP_585CM
SDEV_SONIC_AIR_TEMP_45CM
SDEV_VIRTUAL_TEMP_ABV_CNPY
SDEV_VIRTUAL_TEMP_2806CM
SDEV_VIRTUAL_TEMP_1860CM
SDEV_VIRTUAL_TEMP_585CM
SDEV_VIRTUAL_TEMP_140CM
SDEV_VIRTUAL_TEMP_45CM
LATENT_HEAT_STORAGE_ABV_CNPY
LATENT_HEAT_STORAGE_2806CM
LATENT_HEAT_STORAGE_1860CM
LATENT_HEAT_STORAGE_585CM
LATENT_HEAT_STORAGE_140CM
LATENT_HEAT_STORAGE_45CM
CO2_STORAGE_ABV_CNPY
CO2_STORAGE_2806CM
CO2_STORAGE_1860CM
CO2_STORAGE_585CM
CO2_STORAGE_140CM
CO2_STORAGE_45CM
WIND_SPEED_3940CM
WIND_DIR_3940CM
AIR_TEMP_2830CM
AIR_TEMP_3730CM
REL_HUM_2830CM
REL_HUM_3730CM
SURF_PRESS
DOWN_SHORTWAVE_RAD_ABV_CNPY
DOWN_PPFD_ABV_CNPY
UP_PPFD_ABV_CNPY
SURF_TEMP_ABV_CNPY
ABS_HUM_ABV_CNPY
OZONE_CONC_ABV_CNPY

OZONE_CONC_BELOW_CNPY
MEAN_AIR_TEMP_ABV_CNPY
MEAN_AIR_TEMP_3010CM
MEAN_AIR_TEMP_2540CM
MEAN_AIR_TEMP_2230CM
MEAN_AIR_TEMP_1920CM
MEAN_AIR_TEMP_1610CM
MEAN_AIR_TEMP_1300CM
MEAN_AIR_TEMP_990CM
MEAN_AIR_TEMP_680CM
MEAN_AIR_TEMP_230CM
MEAN_AIR_TEMP_80CM
SDEV_AIR_TEMP_ABV_CNPY
SDEV_AIR_TEMP_3010CM
SDEV_AIR_TEMP_2540CM
SDEV_AIR_TEMP_2230CM
SDEV_AIR_TEMP_1920CM
SDEV_AIR_TEMP_1610CM
SDEV_AIR_TEMP_1300CM
SDEV_AIR_TEMP_990CM
SDEV_AIR_TEMP_680CM
SDEV_AIR_TEMP_230CM
SDEV_AIR_TEMP_80CM
TIP_BUCKET_PRECIP
CO2_CONC_ABV_CNPY
CO2_CONC_3460CM
CO2_CONC_2540CM
CO2_CONC_2230CM
CO2_CONC_1920CM
CO2_CONC_1610CM
CO2_CONC_990CM
CO2_CONC_230CM
CO2_CONC_80CM
HYGRO_VAPOR_PRESS_ABV_CNPY
HYGRO_VAPOR_PRESS_2540CM
HYGRO_VAPOR_PRESS_2230CM
HYGRO_VAPOR_PRESS_1920CM
HYGRO_VAPOR_PRESS_1610CM
HYGRO_VAPOR_PRESS_990CM
HYGRO_VAPOR_PRESS_230CM
HYGRO_VAPOR_PRESS_80CM
IRGA_VAPOR_PRESS_ABV_CNPY
IRGA_VAPOR_PRESS_2540CM
IRGA_VAPOR_PRESS_2230CM
IRGA_VAPOR_PRESS_1920CM
IRGA_VAPOR_PRESS_1610CM
IRGA_VAPOR_PRESS_990CM
IRGA_VAPOR_PRESS_230CM
IRGA_VAPOR_PRESS_80CM
HYGRO_DEW_POINT_ABV_CNPY
HYGRO_DEW_POINT_3950CM
HYGRO_DEW_POINT_2540CM
HYGRO_DEW_POINT_2230CM
HYGRO_DEW_POINT_1920CM

HYGRO_DEW_POINT_1610CM
HYGRO_DEW_POINT_990CM
HYGRO_DEW_POINT_230CM
HYGRO_DEW_POINT_80CM
IRGA_DEW_POINT_ABV_CNPY
IRGA_DEW_POINT_2540CM
IRGA_DEW_POINT_2230CM
IRGA_DEW_POINT_1920CM
IRGA_DEW_POINT_1610CM
IRGA_DEW_POINT_990CM
IRGA_DEW_POINT_230CM
IRGA_DEW_POINT_80CM
CRTFCN_CODE
REVISION_DATE

7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the data files on the CD-ROM are:

TF02_DAILY_PRECIP

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
TIME_OBS	The Greenwich Mean Time (GMT) of the start of the data collection.
TIP_BUCKET_PRECIP	Precipitation measured using a tipping bucket rain gauge.
BELFORT_PRECIP	Precipitation measured using a Belfort weighing rain gauge.
STANDARD_PRECIP	Precipitation measured using a standard rain gauge.
CRTFCN_CODE	The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

TF02_TOWER_FLUX

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS, in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
TIME_OBS	The Greenwich Mean Time (GMT) of the start of the data collection.
NET_RAD_ABV_CNPY_1	The net radiation measured above the canopy.
NET_RAD_ABV_CNPY_2	A second net radiation measurement made above the canopy.
SENSIBLE_HEAT_FLUX_ABV_CNPY	The sensible heat flux measured above the canopy at 39.5 meters above ground level.
SENSIBLE_HEAT_FLUX_2806CM	The sensible heat flux measured at 28.06 meters above ground level.
SENSIBLE_HEAT_FLUX_585CM	The sensible heat flux measured at 5.85 meters above ground level.
SENSIBLE_HEAT_FLUX_45CM	The sensible heat flux measured at 0.45 meters above ground level.
LATENT_HEAT_FLUX_ABV_CNPY	The latent heat flux measured above the canopy at 39.5 meters above ground level.
LATENT_HEAT_FLUX_2806CM	The latent heat flux measured at 28.06 meters above ground level.
LATENT_HEAT_FLUX_585CM	The latent heat flux measured at 5.85 meters above ground level.
LATENT_HEAT_FLUX_45CM	The latent heat flux measured at 0.45 meters above ground level.
AIR_DENSITY_ABV_CNPY	The air density computed from air temperature above the canopy at 39.5 meters above ground level.
AIR_DENSITY_2806CM	The air density computed from air temperature at 28.06 meters above ground level.
AIR_DENSITY_1860CM	The air density computed from air temperature at 18.6 meters above ground level.
AIR_DENSITY_585CM	The air density computed from air temperature at 5.85 meters above ground level.
AIR_DENSITY_140CM	The air density computed from air temperature at 1.4 meters above ground level.
AIR_DENSITY_45CM	The air density computed from air temperature at 0.45 meters above ground level.
WIND_SPEED_ABV_CNPY	The wind speed measured above the canopy at 39.5 meters above ground level.
WIND_SPEED_2806CM	The wind speed measured at 28.06 meters above ground level.

WIND_SPEED_1860CM	The wind speed measured at 18.6 meters above ground level.
WIND_SPEED_585CM	The wind speed measured at 5.85 meters above ground level.
WIND_SPEED_140CM	The wind speed measured at 1.4 meters above ground level.
WIND_SPEED_45CM	The wind speed measured at 0.45 meters above ground level.
FRICTION_VEL_ABV_CNPY	The friction velocity above the canopy at 39.5 meters above ground level.
FRICTION_VEL_2806CM	The friction velocity at 28.06 meters above ground level.
FRICTION_VEL_1860CM	The friction velocity at 18.6 meters above ground level.
FRICTION_VEL_585CM	The friction velocity at 5.85 meters above ground level.
FRICTION_VEL_140CM	The friction velocity at 1.4 meters above ground level.
FRICTION_VEL_45CM	The friction velocity at 0.45 meters above ground level.
MOMENT_FLUX_ABV_CNPY	Momentum flux density measured above the canopy at 39.5 meters above ground level.
MOMENT_FLUX_2806CM	Momentum flux density measured at 28.06 meters above ground level.
MOMENT_FLUX_1860CM	Momentum flux density measured at 18.6 meters above ground level.
MOMENT_FLUX_585CM	Momentum flux density measured at 5.85 meters above ground level.
MOMENT_FLUX_140CM	Momentum flux density measured at 1.4 meters above ground level.
MOMENT_FLUX_45CM	Momentum flux density measured at 0.45 meters above ground level.
SDEV_W_WIND_SPEED_ABV_CNPY	The 30 minute standard deviation of the vertical wind speed measured above the canopy at 39.5 meters above ground level.
SDEV_W_WIND_SPEED_2806CM	Standard deviation of the vertical wind velocity at 28.06 meters above ground level.
SDEV_W_WIND_SPEED_1860CM	Standard deviation of the vertical wind velocity at 18.6 meters above ground level.
SDEV_W_WIND_SPEED_585CM	Standard deviation of the vertical wind velocity at 5.85 meters above ground level.
SDEV_W_WIND_SPEED_140CM	Standard deviation of the vertical wind velocity at 1.4 meters above ground level.
SDEV_W_WIND_SPEED_45CM	Standard deviation of the vertical wind velocity at 0.45 meters above ground level.
H2O_FLUX_ABV_CNPY	The water vapor flux measured above the canopy at 39.5 meters above ground level.
H2O_FLUX_2806CM	The water vapor flux at 28.06 meters above ground level.
H2O_FLUX_585CM	The water vapor flux at 5.85 meters above ground level.
H2O_FLUX_45CM	The water vapor flux at 0.45 meters above ground level.
CO2_FLUX_ABV_CNPY	The carbon dioxide flux measured above the canopy

	at 39.5 meters above ground level.
CO2_FLUX_2806CM	The carbon dioxide flux at 28.06 meters above ground level.
CO2_FLUX_585CM	The carbon dioxide flux at 5.85 meters above ground level.
CO2_FLUX_45CM	The carbon dioxide flux at 0.45 meters above ground level.
STABILITY_INDEX_ABV_CNPY	The z/L stability index measured above the canopy at 39.5 meters above ground level.
STABILITY_INDEX_2806CM	The z/L stability index at 28.06 meters above ground level.
STABILITY_INDEX_1860CM	The z/L stability index at 18.6 meters above ground level.
STABILITY_INDEX_585CM	The z/L stability index at 5.85 meters above ground level.
STABILITY_INDEX_140CM	The z/L stability index at 1.4 meters above ground level.
STABILITY_INDEX_45CM	The z/L stability index at 0.45 meters above ground level.
SDEV_WIND_DIR_ABV_CNPY	The standard deviation of the wind direction measured above the canopy over a 30 minute period at 39.5 meters above ground level.
SDEV_WIND_DIR_2806CM	The standard deviation of the wind direction at 28.06 meters above ground level over a 30 minute period.
SDEV_WIND_DIR_1860CM	The standard deviation of the wind direction at 18.6 meters above ground level over a 30 minute period.
SDEV_WIND_DIR_585CM	The standard deviation of the wind direction at 5.85 meters above ground level over a 30 minute period.
SDEV_WIND_DIR_140CM	The standard deviation of the wind direction at 1.4 meters above ground level over a 30 minute period.
SDEV_WIND_DIR_45CM	The standard deviation of the wind direction at 0.45 meters above ground level over a 30 minute period.
VIRTUAL_HEAT_FLUX_ABV_CNPY	Virtual heat flux from virtural temperature measured above the canopy by sonic anemometer, corrected for wind effects, at 39.5 meters above ground level.
VIRTUAL_HEAT_FLUX_2806CM	Virtual heat flux from virtural temperature measured at 28.06 meters above ground level by sonic anemometer, corrected for wind effects.
VIRTUAL_HEAT_FLUX_1860CM	Virtual heat flux from virtural temperature measured at 18.6 meters above ground level by sonic anemometer, corrected for wind effects.
VIRTUAL_HEAT_FLUX_585CM	Virtual heat flux from virtural temperature measured at 5.85 meters above ground level by sonic anemometer, corrected for wind effects.
VIRTUAL_HEAT_FLUX_140CM	Virtual heat flux from virtural temperature measured at 1.4 meters above ground level by sonic anemometer, corrected for wind effects.
VIRTUAL_HEAT_FLUX_45CM	Virtual heat flux from virtural temperature

	measured at 0.45 meters above ground level by sonic anemometer, corrected for wind effects.
SDEV_SONIC_AIR_TEMP_ABV_CNPY	Standard deviation of air temperature measured above the canopy by sonic anemometer, corrected for wind and humidity effects, at 39.5 meters above ground level.
SDEV_SONIC_AIR_TEMP_2806CM	Standard deviation of air temperature measured at 28.06 meters above ground level by sonic anemometer, corrected for wind and humidity effects.
SDEV_SONIC_AIR_TEMP_585CM	Standard deviation of air temperature measured at 5.85 meters above ground level by sonic anemometer, corrected for wind and humidity effects.
SDEV_SONIC_AIR_TEMP_45CM	Standard deviation of air temperature measured at 0.45 meters above ground level by sonic anemometer, corrected for wind and humidity effects.
SDEV_VIRTUAL_TEMP_ABV_CNPY	Standard deviation of virtual temperature measured above the canopy by sonic anemometer, corrected for wind effects, at 39.5 meters above ground level.
SDEV_VIRTUAL_TEMP_2806CM	Standard deviation of virtual temperature measured at 28.06 meters above ground level by sonic anemometer, corrected for wind effects.
SDEV_VIRTUAL_TEMP_1860CM	Standard deviation of virtual temperature measured at 18.6 meters above ground level by sonic anemometer, corrected for wind effects.
SDEV_VIRTUAL_TEMP_585CM	Standard deviation of virtual temperature measured at 5.85 meters above ground level by sonic anemometer, corrected for wind effects.
SDEV_VIRTUAL_TEMP_140CM	Standard deviation of virtual temperature measured at 1.4 meters above ground level by sonic anemometer, corrected for wind effects.
SDEV_VIRTUAL_TEMP_45CM	Standard deviation of virtual temperature measured at 0.45 meters above ground level by sonic anemometer, corrected for wind effects.
LATENT_HEAT_STORAGE_ABV_CNPY	The storage term for latent heat flux under the eddy flux system, measured above the canopy at 39.5 meters above ground level.
LATENT_HEAT_STORAGE_2806CM	The storage term for latent heat flux under the eddy flux system, measured at 28.06 meters above ground level.
LATENT_HEAT_STORAGE_1860CM	The storage term for latent heat flux under the eddy flux system, measured at 18.6 meters above ground level.
LATENT_HEAT_STORAGE_585CM	The storage term for latent heat flux under the eddy flux system, measured at 5.85 meters above ground level.
LATENT_HEAT_STORAGE_140CM	The storage term for latent heat flux under the eddy flux system, measured at 1.4 meters above ground level.
LATENT_HEAT_STORAGE_45CM	The storage term for latent heat flux under the eddy flux system, measured at 0.45 meters above

	ground level.
CO2_STORAGE_ABV_CNPY	The storage term for CO2 flux under the eddy flux system, measured above the canopy, at 39.5 meters above ground level.
CO2_STORAGE_2806CM	The storage term for CO2 flux under the eddy flux system, measured at 28.06 meters above ground level.
CO2_STORAGE_1860CM	The storage term for CO2 flux under the eddy flux system, measured at 18.6 meters above ground level.
CO2_STORAGE_585CM	The storage term for CO2 flux under the eddy flux system, measured at 5.85 meters above ground level.
CO2_STORAGE_140CM	The storage term for CO2 flux under the eddy flux system, measured at 1.4 meters above ground level.
CO2_STORAGE_45CM	The storage term for CO2 flux under the eddy flux system, measured at 0.45 meters above ground level.
WIND_SPEED_3940CM	The wind speed measured at 39.4 meters above ground level.
WIND_DIR_3940CM	The wind direction at 39.4 meters above ground level.
AIR_TEMP_2830CM	The air temperature at 28.3 meters above ground level.
AIR_TEMP_3730CM	The air temperature at 37.3 meters above ground level.
REL_HUM_2830CM	The relative humidity measured at 28.3 meters above ground level.
REL_HUM_3730CM	The relative humidity measured at 37.3 meters above ground level.
SURF_PRESS	The atmospheric pressure measured at the station.
DOWN_SHORTWAVE_RAD_ABV_CNPY	The downward (incoming) solar radiation measured above the canopy.
DOWN_PPFD_ABV_CNPY	The downward (incoming) photosynthetic photon flux density measured above the canopy.
UP_PPFD_ABV_CNPY	The reflected photosynthetic photon flux density measured above the canopy.
SURF_TEMP_ABV_CNPY	The surface radiation temperature measured from above the canopy.
ABS_HUM_ABV_CNPY	The absolute humidity measured above the canopy.
OZONE_CONC_ABV_CNPY	Ozone concentration measured at 37.4 meters above ground level.
OZONE_CONC_BELOW_CNPY	Ozone concentration measured at 3 meters above ground level.
MEAN_AIR_TEMP_ABV_CNPY	The mean air temperature measured above the canopy over a 30 minute period, at 34.6 meters above ground level.
MEAN_AIR_TEMP_3010CM	The air temperature at 30.1 meters above ground level.
MEAN_AIR_TEMP_2540CM	The air temperature at 25.4 meters above ground level.
MEAN_AIR_TEMP_2230CM	The air temperature at 22.3 meters above ground level.

MEAN_AIR_TEMP_1920CM	The air temperature at 19.2 meters above ground level.
MEAN_AIR_TEMP_1610CM	The air temperature at 16.1 meters above ground level.
MEAN_AIR_TEMP_1300CM	The air temperature at 13.0 meters above ground level.
MEAN_AIR_TEMP_990CM	The air temperature at 9.9 meters above ground level.
MEAN_AIR_TEMP_680CM	The air temperature at 6.8 meters above ground level.
MEAN_AIR_TEMP_230CM	The air temperature at 2.3 meters above ground level.
MEAN_AIR_TEMP_80CM	The air temperature at 0.8 meters above ground level.
SDEV_AIR_TEMP_ABV_CNPY	The standard deviation of the air temperature measured above the canopy over a 30 minute period, at 34.6 meters above ground level.
SDEV_AIR_TEMP_3010CM	The standard deviation of the air temperature measured at 30.1 meters above ground level.
SDEV_AIR_TEMP_2540CM	The standard deviation of the air temperature measured at 25.4 meters above ground level.
SDEV_AIR_TEMP_2230CM	The standard deviation of the air temperature measured at 22.3 meters above ground level.
SDEV_AIR_TEMP_1920CM	The standard deviation of the air temperature measured at 19.2 meters above ground level.
SDEV_AIR_TEMP_1610CM	The standard deviation of the air temperature measured at 16.1 meters above ground level.
SDEV_AIR_TEMP_1300CM	The standard deviation of the air temperature measured at 13.0 meters above ground level.
SDEV_AIR_TEMP_990CM	The standard deviation of the air temperature measured at 9.9 meters above ground level.
SDEV_AIR_TEMP_680CM	The standard deviation of the air temperature measured at 6.8 meters above ground level.
SDEV_AIR_TEMP_230CM	The standard deviation of the air temperature measured at 2.3 meters above ground level.
SDEV_AIR_TEMP_80CM	The standard deviation of the air temperature measured at 0.8 meters above ground level.
TIP_BUCKET_PRECIP	Precipitation measured using a tipping bucket rain gauge.
CO2_CONC_ABV_CNPY	The carbon dioxide concentration measured above the canopy at 34.6 meters above ground level.
CO2_CONC_3460CM	The carbon dioxide concentration at 34.6 meters above ground level.
CO2_CONC_2540CM	The carbon dioxide concentration at 25.4 meters above ground level.
CO2_CONC_2230CM	The carbon dioxide concentration at 22.3 meters above ground level.
CO2_CONC_1920CM	The carbon dioxide concentration at 19.2 meters above ground level.
CO2_CONC_1610CM	The carbon dioxide concentration at 16.1 meters above ground level.
CO2_CONC_990CM	The carbon dioxide concentration at 9.9 meters above ground level.
CO2_CONC_230CM	The carbon dioxide concentration at 2.3 meters

	above ground level.
CO2_CONC_80CM	The carbon dioxide concentration at 0.8 meters above ground level.
HYGRO_VAPOR_PRESS_ABV_CNPY	The vapor pressure above the canopy measured using a dew point hygrometer at 34.6 meters above ground level.
HYGRO_VAPOR_PRESS_2540CM	The vapor pressure at 25.4 meters above ground level measured using a dew point hygrometer.
HYGRO_VAPOR_PRESS_2230CM	The vapor pressure at 22.3 meters above ground level measured using a dew point hygrometer.
HYGRO_VAPOR_PRESS_1920CM	The vapor pressure at 19.2 meters above ground level measured using a dew point hygrometer.
HYGRO_VAPOR_PRESS_1610CM	The vapor pressure at 16.1 meters above ground level measured using a dew point hygrometer.
HYGRO_VAPOR_PRESS_990CM	The vapor pressure at 9.9 meters above ground level measured using a dew point hygrometer.
HYGRO_VAPOR_PRESS_230CM	The vapor pressure at 2.3 meters above ground level measured using a dew point hygrometer.
HYGRO_VAPOR_PRESS_80CM	The vapor pressure at 0.8 meters above ground level measured using a dew point hygrometer.
IRGA_VAPOR_PRESS_ABV_CNPY	The vapor pressure above the canopy measured using an infrared gas analyzer (IRGA) at 34.6 meters above ground level.
IRGA_VAPOR_PRESS_2540CM	The vapor pressure at 25.4 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_VAPOR_PRESS_2230CM	The vapor pressure at 22.3 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_VAPOR_PRESS_1920CM	The vapor pressure at 19.2 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_VAPOR_PRESS_1610CM	The vapor pressure at 16.1 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_VAPOR_PRESS_990CM	The vapor pressure at 9.9 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_VAPOR_PRESS_230CM	The vapor pressure at 2.3 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_VAPOR_PRESS_80CM	The vapor pressure at 0.8 meters above ground level measured using an infrared gas analyzer (IRGA).
HYGRO_DEW_POINT_ABV_CNPY	The dew point temperature above the canopy measured using a dew point hygrometer at 34.6 meters above ground level.
HYGRO_DEW_POINT_3950CM	The dew point temperature at 39.5 meters above ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_2540CM	The dew point temperature at 25.4 meters above ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_2230CM	The dew point temperature at 22.3 meters above

	ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_1920CM	The dew point temperature at 19.2 meters above ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_1610CM	The dew point temperature at 16.1 meters above ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_990CM	The dew point temperature at 9.9 meters above ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_230CM	The dew point temperature at 2.3 meters above ground level measured using a dew point hygrometer.
HYGRO_DEW_POINT_80CM	The dew point temperature at 0.8 meters above ground level measured using a dew point hygrometer.
IRGA_DEW_POINT_ABV_CNPY	The dew point temperature above the canopy measured using an infrared gas analyzer (IRGA), at 34.6 meters above ground level.
IRGA_DEW_POINT_2540CM	The dew point temperature at 25.4 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_DEW_POINT_2230CM	The dew point temperature at 22.3 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_DEW_POINT_1920CM	The dew point temperature at 19.2 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_DEW_POINT_1610CM	The dew point temperature at 16.1 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_DEW_POINT_990CM	The dew point temperature at 9.9 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_DEW_POINT_230CM	The dew point temperature at 2.3 meters above ground level measured using an infrared gas analyzer (IRGA).
IRGA_DEW_POINT_80CM	The dew point temperature at 0.8 meters above ground level measured using an infrared gas analyzer (IRGA).
CRTFCN_CODE	The BOREAS certification level of the data. Examples are CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

7.3.3 Unit of Measurement

The measurement units for the parameters contained in the data files on the CD-ROM are:

TF02_DAILY_PRECIP

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
TIP_BUCKET_PRECIP	[millimeters]
BELFORT_PRECIP	[millimeters]
STANDARD_PRECIP	[millimeters]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

TF02_TOWER_FLUX

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
NET_RAD_ABV_CNPY_1	[Watts][meter^-2]
NET_RAD_ABV_CNPY_2	[Watts][meter^-2]
SENSIBLE_HEAT_FLUX_ABV_CNPY	[Watts][meter^-2]
SENSIBLE_HEAT_FLUX_2806CM	[Watts][meter^-2]
SENSIBLE_HEAT_FLUX_585CM	[Watts][meter^-2]
SENSIBLE_HEAT_FLUX_45CM	[Watts][meter^-2]
LATENT_HEAT_FLUX_ABV_CNPY	[Watts][meter^-2]
LATENT_HEAT_FLUX_2806CM	[Watts][meter^-2]
LATENT_HEAT_FLUX_585CM	[Watts][meter^-2]
LATENT_HEAT_FLUX_45CM	[Watts][meter^-2]
AIR_DENSITY_ABV_CNPY	[kilograms][meter^-3]
AIR_DENSITY_2806CM	[kilograms][meter^-3]
AIR_DENSITY_1860CM	[kilograms][meter^-3]
AIR_DENSITY_585CM	[kilograms][meter^-3]
AIR_DENSITY_140CM	[kilograms][meter^-3]
AIR_DENSITY_45CM	[kilograms][meter^-3]
WIND_SPEED_ABV_CNPY	[meters][second^-1]
WIND_SPEED_2806CM	[meters][second^-1]
WIND_SPEED_1860CM	[meters][second^-1]
WIND_SPEED_585CM	[meters][second^-1]
WIND_SPEED_140CM	[meters][second^-1]
WIND_SPEED_45CM	[meters][second^-1]
FRICTION_VEL_ABV_CNPY	[meters][second^-1]
FRICTION_VEL_2806CM	[meters][second^-1]
FRICTION_VEL_1860CM	[meters][second^-1]
FRICTION_VEL_585CM	[meters][second^-1]
FRICTION_VEL_140CM	[meters][second^-1]
FRICTION_VEL_45CM	[meters][second^-1]
MOMENT_FLUX_ABV_CNPY	[meters^2][second^-2]
MOMENT_FLUX_2806CM	[meters^2][second^-2]
MOMENT_FLUX_1860CM	[meters^2][second^-2]

MOMENT_FLUX_585CM	[meters^2][second^-2]
MOMENT_FLUX_140CM	[meters^2][second^-2]
MOMENT_FLUX_45CM	[meters^2][second^-2]
SDEV_W_WIND_SPEED_ABV_CNPY	[meters][second^-1]
SDEV_W_WIND_SPEED_2806CM	[meters][second^-1]
SDEV_W_WIND_SPEED_1860CM	[meters][second^-1]
SDEV_W_WIND_SPEED_585CM	[meters][second^-1]
SDEV_W_WIND_SPEED_140CM	[meters][second^-1]
SDEV_W_WIND_SPEED_45CM	[meters][second^-1]
H2O_FLUX_ABV_CNPY	[millimoles][meter^-2][second^-1]
H2O_FLUX_2806CM	[millimoles][meter^-2][second^-1]
H2O_FLUX_585CM	[millimoles][meter^-2][second^-1]
H2O_FLUX_45CM	[millimoles][meter^-2][second^-1]
CO2_FLUX_ABV_CNPY	[micromoles][meter^-2][second^-1]
CO2_FLUX_2806CM	[micromoles][meter^-2][second^-1]
CO2_FLUX_585CM	[micromoles][meter^-2][second^-1]
CO2_FLUX_45CM	[micromoles][meter^-2][second^-1]
STABILITY_INDEX_ABV_CNPY	[unitless]
STABILITY_INDEX_2806CM	[unitless]
STABILITY_INDEX_1860CM	[unitless]
STABILITY_INDEX_585CM	[unitless]
STABILITY_INDEX_140CM	[unitless]
STABILITY_INDEX_45CM	[unitless]
SDEV_WIND_DIR_ABV_CNPY	[degrees from north]
SDEV_WIND_DIR_2806CM	[degrees from north]
SDEV_WIND_DIR_1860CM	[degrees from north]
SDEV_WIND_DIR_585CM	[degrees from north]
SDEV_WIND_DIR_140CM	[degrees from north]
SDEV_WIND_DIR_45CM	[degrees from north]
VIRTUAL_HEAT_FLUX_ABV_CNPY	[Watts][meter^-2]
VIRTUAL_HEAT_FLUX_2806CM	[Watts][meter^-2]
VIRTUAL_HEAT_FLUX_1860CM	[Watts][meter^-2]
VIRTUAL_HEAT_FLUX_585CM	[Watts][meter^-2]
VIRTUAL_HEAT_FLUX_140CM	[Watts][meter^-2]
VIRTUAL_HEAT_FLUX_45CM	[Watts][meter^-2]
SDEV_SONIC_AIR_TEMP_ABV_CNPY	[degrees Celsius]
SDEV_SONIC_AIR_TEMP_2806CM	[degrees Celsius]
SDEV_SONIC_AIR_TEMP_585CM	[degrees Celsius]
SDEV_SONIC_AIR_TEMP_45CM	[degrees Celsius]
SDEV_VIRTUAL_TEMP_ABV_CNPY	[degrees Celsius]
SDEV_VIRTUAL_TEMP_2806CM	[degrees Celsius]
SDEV_VIRTUAL_TEMP_1860CM	[degrees Celsius]
SDEV_VIRTUAL_TEMP_585CM	[degrees Celsius]
SDEV_VIRTUAL_TEMP_140CM	[degrees Celsius]
SDEV_VIRTUAL_TEMP_45CM	[degrees Celsius]
LATENT_HEAT_STORAGE_ABV_CNPY	[Watts][meter^-2]
LATENT_HEAT_STORAGE_2806CM	[Watts][meter^-2]
LATENT_HEAT_STORAGE_1860CM	[Watts][meter^-2]
LATENT_HEAT_STORAGE_585CM	[Watts][meter^-2]
LATENT_HEAT_STORAGE_140CM	[Watts][meter^-2]
LATENT_HEAT_STORAGE_45CM	[Watts][meter^-2]
CO2_STORAGE_ABV_CNPY	[micromoles][meter^-2][second^-1]
CO2_STORAGE_2806CM	[micromoles][meter^-2][second^-1]
CO2_STORAGE_1860CM	[micromoles][meter^-2][second^-1]

CO2_STORAGE_585CM	[micromoles][meter^-2][second^-1]
CO2_STORAGE_140CM	[micromoles][meter^-2][second^-1]
CO2_STORAGE_45CM	[micromoles][meter^-2][second^-1]
WIND_SPEED_3940CM	[meters][second^-1]
WIND_DIR_3940CM	[degrees from north]
AIR_TEMP_2830CM	[degrees Celsius]
AIR_TEMP_3730CM	[degrees Celsius]
REL_HUM_2830CM	[percent]
REL_HUM_3730CM	[percent]
SURF_PRESS	[kiloPascals]
DOWN_SHORTWAVE_RAD_ABV_CNPY	[Watts][meter^-2]
DOWN_PPFD_ABV_CNPY	[micromoles][meter^-2][second^-1]
UP_PPFD_ABV_CNPY	[micromoles][meter^-2][second^-1]
SURF_TEMP_ABV_CNPY	[degrees Celsius]
ABS_HUM_ABV_CNPY	[grams][meter^-3]
OZONE_CONC_ABV_CNPY	[parts per billion]
OZONE_CONC_BELOW_CNPY	[parts per billion]
MEAN_AIR_TEMP_ABV_CNPY	[degrees Celsius]
MEAN_AIR_TEMP_3010CM	[degrees Celsius]
MEAN_AIR_TEMP_2540CM	[degrees Celsius]
MEAN_AIR_TEMP_2230CM	[degrees Celsius]
MEAN_AIR_TEMP_1920CM	[degrees Celsius]
MEAN_AIR_TEMP_1610CM	[degrees Celsius]
MEAN_AIR_TEMP_1300CM	[degrees Celsius]
MEAN_AIR_TEMP_990CM	[degrees Celsius]
MEAN_AIR_TEMP_680CM	[degrees Celsius]
MEAN_AIR_TEMP_230CM	[degrees Celsius]
MEAN_AIR_TEMP_80CM	[degrees Celsius]
SDEV_AIR_TEMP_ABV_CNPY	[degrees Celsius]
SDEV_AIR_TEMP_3010CM	[degrees Celsius]
SDEV_AIR_TEMP_2540CM	[degrees Celsius]
SDEV_AIR_TEMP_2230CM	[degrees Celsius]
SDEV_AIR_TEMP_1920CM	[degrees Celsius]
SDEV_AIR_TEMP_1610CM	[degrees Celsius]
SDEV_AIR_TEMP_1300CM	[degrees Celsius]
SDEV_AIR_TEMP_990CM	[degrees Celsius]
SDEV_AIR_TEMP_680CM	[degrees Celsius]
SDEV_AIR_TEMP_230CM	[degrees Celsius]
SDEV_AIR_TEMP_80CM	[degrees Celsius]
TIP_BUCKET_PRECIP	[millimeters]
CO2_CONC_ABV_CNPY	[parts per million]
CO2_CONC_3460CM	[parts per million]
CO2_CONC_2540CM	[parts per million]
CO2_CONC_2230CM	[parts per million]
CO2_CONC_1920CM	[parts per million]
CO2_CONC_1610CM	[parts per million]
CO2_CONC_990CM	[parts per million]
CO2_CONC_230CM	[parts per million]
CO2_CONC_80CM	[parts per million]
HYGRO_VAPOR_PRESS_ABV_CNPY	[kiloPascals]
HYGRO_VAPOR_PRESS_2540CM	[kiloPascals]
HYGRO_VAPOR_PRESS_2230CM	[kiloPascals]
HYGRO_VAPOR_PRESS_1920CM	[kiloPascals]
HYGRO_VAPOR_PRESS_1610CM	[kiloPascals]

HYGRO_VAPOR_PRESS_990CM	[kiloPascals]
HYGRO_VAPOR_PRESS_230CM	[kiloPascals]
HYGRO_VAPOR_PRESS_80CM	[kiloPascals]
IRGA_VAPOR_PRESS_ABV_CNPY	[kiloPascals]
IRGA_VAPOR_PRESS_2540CM	[kiloPascals]
IRGA_VAPOR_PRESS_2230CM	[kiloPascals]
IRGA_VAPOR_PRESS_1920CM	[kiloPascals]
IRGA_VAPOR_PRESS_1610CM	[kiloPascals]
IRGA_VAPOR_PRESS_990CM	[kiloPascals]
IRGA_VAPOR_PRESS_230CM	[kiloPascals]
IRGA_VAPOR_PRESS_80CM	[kiloPascals]
HYGRO_DEW_POINT_ABV_CNPY	[degrees Celsius]
HYGRO_DEW_POINT_3950CM	[degrees Celsius]
HYGRO_DEW_POINT_2540CM	[degrees Celsius]
HYGRO_DEW_POINT_2230CM	[degrees Celsius]
HYGRO_DEW_POINT_1920CM	[degrees Celsius]
HYGRO_DEW_POINT_1610CM	[degrees Celsius]
HYGRO_DEW_POINT_990CM	[degrees Celsius]
HYGRO_DEW_POINT_230CM	[degrees Celsius]
HYGRO_DEW_POINT_80CM	[degrees Celsius]
IRGA_DEW_POINT_ABV_CNPY	[degrees Celsius]
IRGA_DEW_POINT_2540CM	[degrees Celsius]
IRGA_DEW_POINT_2230CM	[degrees Celsius]
IRGA_DEW_POINT_1920CM	[degrees Celsius]
IRGA_DEW_POINT_1610CM	[degrees Celsius]
IRGA_DEW_POINT_990CM	[degrees Celsius]
IRGA_DEW_POINT_230CM	[degrees Celsius]
IRGA_DEW_POINT_80CM	[degrees Celsius]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

7.3.4 Data Source

The source of the parameter values contained in the data files on the CD-ROM are:

TF02_DAILY_PRECIP

Column Name	Data Source
SITE_NAME	[Assigned by BORIS.]
SUB_SITE	[Assigned by BORIS.]
DATE_OBS	[Supplied by Investigator.]
TIME_OBS	[Supplied by Investigator.]
TIP_BUCKET_PRECIP	[tipping bucket rain gauge]
BELFORT_PRECIP	[Belfort rain gauge]
STANDARD_PRECIP	[Standard rain gauge]
CRTFCN_CODE	[Assigned by BORIS.]
REVISION_DATE	[Assigned by BORIS.]

TF02_TOWER_FLUX

Column Name	Data Source
SITE_NAME	[Assigned by BORIS.]
SUB_SITE	[Assigned by BORIS.]
DATE_OBS	[Supplied by Investigator.]
TIME_OBS	[Supplied by Investigator.]

NET_RAD_ABV_CNPY_1	[Net radiometer]
NET_RAD_ABV_CNPY_2	[Net radiometer]
SENSIBLE_HEAT_FLUX_ABV_CNPY	[Sonic anemometer]
SENSIBLE_HEAT_FLUX_2806CM	[Sonic anemometer]
SENSIBLE_HEAT_FLUX_585CM	[Sonic anemometer]
SENSIBLE_HEAT_FLUX_45CM	[Sonic anemometer]
LATENT_HEAT_FLUX_ABV_CNPY	[IRGA]
LATENT_HEAT_FLUX_2806CM	[IRGA]
LATENT_HEAT_FLUX_585CM	[IRGA]
LATENT_HEAT_FLUX_45CM	[IRGA]
AIR_DENSITY_ABV_CNPY	[Sonic anemometer]
AIR_DENSITY_2806CM	[Sonic anemometer]
AIR_DENSITY_1860CM	[Sonic anemometer]
AIR_DENSITY_585CM	[Sonic anemometer]
AIR_DENSITY_140CM	[Sonic anemometer]
AIR_DENSITY_45CM	[Sonic anemometer]
WIND_SPEED_ABV_CNPY	[Sonic anemometer]
WIND_SPEED_2806CM	[Sonic anemometer]
WIND_SPEED_1860CM	[Sonic anemometer]
WIND_SPEED_585CM	[Sonic anemometer]
WIND_SPEED_140CM	[Sonic anemometer]
WIND_SPEED_45CM	[Sonic anemometer]
FRICTION_VEL_ABV_CNPY	[Sonic anemometer]
FRICTION_VEL_2806CM	[Sonic anemometer]
FRICTION_VEL_1860CM	[Sonic anemometer]
FRICTION_VEL_585CM	[Sonic anemometer]
FRICTION_VEL_140CM	[Sonic anemometer]
FRICTION_VEL_45CM	[Sonic anemometer]
MOMENT_FLUX_ABV_CNPY	[Sonic anemometer]
MOMENT_FLUX_2806CM	[Sonic anemometer]
MOMENT_FLUX_1860CM	[Sonic anemometer]
MOMENT_FLUX_585CM	[Sonic anemometer]
MOMENT_FLUX_140CM	[Sonic anemometer]
MOMENT_FLUX_45CM	[Sonic anemometer]
SDEV_W_WIND_SPEED_ABV_CNPY	[Sonic anemometer]
SDEV_W_WIND_SPEED_2806CM	[Sonic anemometer]
SDEV_W_WIND_SPEED_1860CM	[Sonic anemometer]
SDEV_W_WIND_SPEED_585CM	[Sonic anemometer]
SDEV_W_WIND_SPEED_140CM	[Sonic anemometer]
SDEV_W_WIND_SPEED_45CM	[Sonic anemometer]
H2O_FLUX_ABV_CNPY	[IRGA]
H2O_FLUX_2806CM	[IRGA]
H2O_FLUX_585CM	[IRGA]
H2O_FLUX_45CM	[IRGA]
CO2_FLUX_ABV_CNPY	[IRGA]
CO2_FLUX_2806CM	[IRGA]
CO2_FLUX_585CM	[IRGA]
CO2_FLUX_45CM	[IRGA]
STABILITY_INDEX_ABV_CNPY	[Sonic anemometer]
STABILITY_INDEX_2806CM	[Sonic anemometer]
STABILITY_INDEX_1860CM	[Sonic anemometer]
STABILITY_INDEX_585CM	[Sonic anemometer]
STABILITY_INDEX_140CM	[Sonic anemometer]
STABILITY_INDEX_45CM	[Sonic anemometer]

SDEV_WIND_DIR_ABV_CNPY	[Sonic anemometer]
SDEV_WIND_DIR_2806CM	[Sonic anemometer]
SDEV_WIND_DIR_1860CM	[Sonic anemometer]
SDEV_WIND_DIR_585CM	[Sonic anemometer]
SDEV_WIND_DIR_140CM	[Sonic anemometer]
SDEV_WIND_DIR_45CM	[Sonic anemometer]
VIRTUAL_HEAT_FLUX_ABV_CNPY	[Sonic anemometer]
VIRTUAL_HEAT_FLUX_2806CM	[Sonic anemometer]
VIRTUAL_HEAT_FLUX_1860CM	[Sonic anemometer]
VIRTUAL_HEAT_FLUX_585CM	[Sonic anemometer]
VIRTUAL_HEAT_FLUX_140CM	[Sonic anemometer]
VIRTUAL_HEAT_FLUX_45CM	[Sonic anemometer]
SDEV_SONIC_AIR_TEMP_ABV_CNPY	[Sonic anemometer]
SDEV_SONIC_AIR_TEMP_2806CM	[Sonic anemometer]
SDEV_SONIC_AIR_TEMP_585CM	[Sonic anemometer]
SDEV_SONIC_AIR_TEMP_45CM	[Sonic anemometer]
SDEV_VIRTUAL_TEMP_ABV_CNPY	[Sonic anemometer]
SDEV_VIRTUAL_TEMP_2806CM	[Sonic anemometer]
SDEV_VIRTUAL_TEMP_1860CM	[Sonic anemometer]
SDEV_VIRTUAL_TEMP_585CM	[Sonic anemometer]
SDEV_VIRTUAL_TEMP_140CM	[Sonic anemometer]
SDEV_VIRTUAL_TEMP_45CM	[Sonic anemometer]
LATENT_HEAT_STORAGE_ABV_CNPY	[IRGA]
LATENT_HEAT_STORAGE_2806CM	[IRGA]
LATENT_HEAT_STORAGE_1860CM	[IRGA]
LATENT_HEAT_STORAGE_585CM	[IRGA]
LATENT_HEAT_STORAGE_140CM	[IRGA]
LATENT_HEAT_STORAGE_45CM	[IRGA]
CO2_STORAGE_ABV_CNPY	[IRGA]
CO2_STORAGE_2806CM	[IRGA]
CO2_STORAGE_1860CM	[IRGA]
CO2_STORAGE_585CM	[IRGA]
CO2_STORAGE_140CM	[IRGA]
CO2_STORAGE_45CM	[IRGA]
WIND_SPEED_3940CM	[vane propeller anemometer]
WIND_DIR_3940CM	[vane propeller anemometer]
AIR_TEMP_2830CM	[thermocouple]
AIR_TEMP_3730CM	[thermocouple]
REL_HUM_2830CM	[dewpoint hygrometer]
REL_HUM_3730CM	[dewpoint hygrometer]
SURF_PRESS	[barometer]
DOWN_SHORTWAVE_RAD_ABV_CNPY	[pyranometer]
DOWN_PPFD_ABV_CNPY	[quantum sensor]
UP_PPFD_ABV_CNPY	[quantum sensor]
SURF_TEMP_ABV_CNPY	[IR thermometer]
ABS_HUM_ABV_CNPY	[dewpoint hygrometer]
OZONE_CONC_ABV_CNPY	[Ozone sensor]
OZONE_CONC_BELOW_CNPY	[Ozone sensor]
MEAN_AIR_TEMP_ABV_CNPY	[thermocouple]
MEAN_AIR_TEMP_3010CM	[thermocouple]
MEAN_AIR_TEMP_2540CM	[thermocouple]
MEAN_AIR_TEMP_2230CM	[thermocouple]
MEAN_AIR_TEMP_1920CM	[thermocouple]
MEAN_AIR_TEMP_1610CM	[thermocouple]

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MEAN_AIR_TEMP_1300CM          [thermocouple]
MEAN_AIR_TEMP_990CM           [thermocouple]
MEAN_AIR_TEMP_680CM           [thermocouple]
MEAN_AIR_TEMP_230CM           [thermocouple]
MEAN_AIR_TEMP_80CM            [thermocouple]
SDEV_AIR_TEMP_ABV_CNPY        [thermocouple]
SDEV_AIR_TEMP_3010CM          [thermocouple]
SDEV_AIR_TEMP_2540CM          [thermocouple]
SDEV_AIR_TEMP_2230CM          [thermocouple]
SDEV_AIR_TEMP_1920CM          [thermocouple]
SDEV_AIR_TEMP_1610CM          [thermocouple]
SDEV_AIR_TEMP_1300CM          [thermocouple]
SDEV_AIR_TEMP_990CM           [thermocouple]
SDEV_AIR_TEMP_680CM           [thermocouple]
SDEV_AIR_TEMP_230CM           [thermocouple]
SDEV_AIR_TEMP_80CM            [thermocouple]
TIP_BUCKET_PRECIP             [tipping bucket rain gauge]
CO2_CONC_ABV_CNPY             [IRGA]
CO2_CONC_3460CM               [IRGA]
CO2_CONC_2540CM               [IRGA]
CO2_CONC_2230CM               [IRGA]
CO2_CONC_1920CM               [IRGA]
CO2_CONC_1610CM               [IRGA]
CO2_CONC_990CM                [IRGA]
CO2_CONC_230CM                [IRGA]
CO2_CONC_80CM                 [IRGA]
HYGRO_VAPOR_PRESS_ABV_CNPY    [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_2540CM      [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_2230CM      [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_1920CM      [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_1610CM      [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_990CM       [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_230CM       [dewpoint hygrometer]
HYGRO_VAPOR_PRESS_80CM        [dewpoint hygrometer]
IRGA_VAPOR_PRESS_ABV_CNPY     [IRGA]
IRGA_VAPOR_PRESS_2540CM       [IRGA]
IRGA_VAPOR_PRESS_2230CM       [IRGA]
IRGA_VAPOR_PRESS_1920CM       [IRGA]
IRGA_VAPOR_PRESS_1610CM       [IRGA]
IRGA_VAPOR_PRESS_990CM        [IRGA]
IRGA_VAPOR_PRESS_230CM        [IRGA]
IRGA_VAPOR_PRESS_80CM         [IRGA]
HYGRO_DEW_POINT_ABV_CNPY      [dewpoint hygrometer]
HYGRO_DEW_POINT_3950CM        [dewpoint hygrometer]
HYGRO_DEW_POINT_2540CM        [dewpoint hygrometer]
HYGRO_DEW_POINT_2230CM        [dewpoint hygrometer]
HYGRO_DEW_POINT_1920CM        [dewpoint hygrometer]
HYGRO_DEW_POINT_1610CM        [dewpoint hygrometer]
HYGRO_DEW_POINT_990CM         [dewpoint hygrometer]
HYGRO_DEW_POINT_230CM         [dewpoint hygrometer]
HYGRO_DEW_POINT_80CM          [dewpoint hygrometer]
IRGA_DEW_POINT_ABV_CNPY       [IRGA]
IRGA_DEW_POINT_2540CM         [IRGA]
IRGA_DEW_POINT_2230CM         [IRGA]
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IRGA_DEW_POINT_1920CM	[IRGA]
IRGA_DEW_POINT_1610CM	[IRGA]
IRGA_DEW_POINT_990CM	[IRGA]
IRGA_DEW_POINT_230CM	[IRGA]
IRGA_DEW_POINT_80CM	[IRGA]
CRTFCN_CODE	[Assigned by BORIS.]
REVISION_DATE	[Assigned by BORIS.]

7.3.5 Data Range

The following table gives information about the parameter values found in the data files on the CD-ROM.

TF02_DAILY_PRECIP

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SITE_NAME	SSA-9OA-FLXTR	SSA-9OA-FLXTR	None	None	None	None
SUB_SITE	9TF02-DPR01	9TF02-DPR01	None	None	None	None
DATE_OBS	31-JAN-94	19-SEP-94	None	None	None	None
TIME_OBS	1500	1500	None	None	None	None
TIP_BUCKET_PRECIP	0	68.8	-999	None	None	None
BELFORT_PRECIP	0	61	None	None	None	None
STANDARD_PRECIP	0	59.2	-999	None	None	None
CRTFCN_CODE	CPI	CPI	None	None	None	None
REVISION_DATE	03-AUG-99	03-AUG-99	None	None	None	None

TF02_TOWER_FLUX

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SITE_NAME	SSA-9OA-FLXTR	SSA-9OA-FLXTR	None	None	None	None
SUB_SITE	9TF02-FLX01	9TF02-FLX01	None	None	None	None
DATE_OBS	01-JAN-94	19-SEP-94	None	None	None	None
TIME_OBS	0	2330	None	None	None	None
NET_RAD_ABV_CNPY_1	-116.1	763.4	-999	None	None	None
NET_RAD_ABV_CNPY_2	-94.71	712.8	-999	None	None	None
SENSIBLE_HEAT_FLUX_ABV_CNPY	-124.6	540.1	-999	None	None	Blank
SENSIBLE_HEAT_FLUX_2806CM	-56.63	277.3	-999	None	None	Blank
SENSIBLE_HEAT_FLUX_585CM	-44.22	84.79	-999	None	None	Blank
SENSIBLE_HEAT_FLUX_45CM	-8.127	18.03	-999	None	None	Blank
LATENT_HEAT_FLUX_ABV_CNPY	-11.85	499	-999	None	None	Blank
LATENT_HEAT_FLUX_2806CM	-8.639	253.3	-999	None	None	Blank
LATENT_HEAT_FLUX_585CM	-11.57	145	-999	None	None	Blank
LATENT_HEAT_FLUX_	-4.985	62.36	-999	None	None	Blank

45CM						
AIR_DENSITY_ABV_CNPY	1.089	1.383	-9.99	None	None	Blank
AIR_DENSITY_2806CM	1.091	1.34	-9.99	None	None	Blank
AIR_DENSITY_1860CM	1.089	1.189	-9.99	None	None	Blank
AIR_DENSITY_585CM	1.09	1.255	-9.99	None	None	Blank
AIR_DENSITY_140CM	0	1.203	-9.99	None	None	Blank
AIR_DENSITY_45CM	1.085	1.194	-9.99	None	None	Blank
WIND_SPEED_ABV_CNPY	.217	14.3	-999	None	None	Blank
WIND_SPEED_2806CM	.1821	11.23	-999	None	None	Blank
WIND_SPEED_1860CM	.09447	1.698	-999	None	None	Blank
WIND_SPEED_585CM	.11	2.078	-999	None	None	Blank
WIND_SPEED_140CM	0	.8121	-999	None	None	Blank
WIND_SPEED_45CM	.02112	.4528	-999	None	None	Blank
FRICTION_VEL_ABV_ CNPY	.003	2.225	-999	None	None	Blank
FRICTION_VEL_2806CM	.002929	2.475	-999	None	None	Blank
FRICTION_VEL_1860CM	.00346	1.426	-999	None	None	Blank
FRICTION_VEL_585CM	.0001958	.5253	-999	None	None	Blank
FRICTION_VEL_140CM	0	.2277	-999	None	None	Blank
FRICTION_VEL_45CM	.0002092	.1218	-999	None	None	Blank
MOMENT_FLUX_ABV_CNPY	-4.952	.04412	-999	None	None	Blank
MOMENT_FLUX_2806CM	-6.128	.02712	-999	None	None	Blank
MOMENT_FLUX_1860CM	-2.032	.01797	-999	None	None	Blank
MOMENT_FLUX_585CM	-.276	.0547	-999	None	None	Blank
MOMENT_FLUX_140CM	-.05183	.007978	-999	None	None	Blank
MOMENT_FLUX_45CM	-.01484	.004387	-999	None	None	Blank
SDEV_W_WIND_SPEED_ ABV_CNPY	.01	2.663	-999	None	None	Blank
SDEV_W_WIND_SPEED_ 2806CM	.02236	2.626	-999	None	None	Blank
SDEV_W_WIND_SPEED_ 1860CM	.02396	1.497	-999	None	None	Blank
SDEV_W_WIND_SPEED_ 585CM	.02116	.7543	-999	None	None	Blank
SDEV_W_WIND_SPEED_ 140CM	.01798	.2636	-999	None	None	Blank
SDEV_W_WIND_SPEED_ 45CM	.01257	.0992	-999	None	None	Blank
H2O_FLUX_ABV_CNPY	-925	40.6278	-999	None	None	Blank
H2O_FLUX_2806CM	-.193667	5.711111	-999	None	None	Blank
H2O_FLUX_585CM	-.261278	3.293333	-999	None	None	Blank
H2O_FLUX_45CM	-115.111111	8.183333	-999	None	None	Blank
CO2_FLUX_ABV_CNPY	-30.14	13.15	-999	None	None	Blank
CO2_FLUX_2806CM	-26.2	9.98	-999	None	None	Blank
CO2_FLUX_585CM	-5.97	14.74	-999	None	None	Blank
CO2_FLUX_45CM	-2.984	10.38	-999	None	None	Blank
STABILITY_INDEX_ABV_ CNPY	-2130	37620	-999	None	None	Blank
STABILITY_INDEX_ 2806CM	-1396	638.5	-999	None	None	Blank
STABILITY_INDEX_ 1860CM	-2324	3062	-999	None	None	Blank
STABILITY_INDEX_ 585CM	-9188	659700	-999	None	None	Blank

STABILITY_INDEX_140CM	-6482	190800	-999	None	None	Blank
STABILITY_INDEX_45CM	-9943	355800	-999	None	None	Blank
SDEV_WIND_DIR_ABV_CNPY	0	100.2	-999	None	None	Blank
SDEV_WIND_DIR_2806CM	0	99.32	-999	None	None	Blank
SDEV_WIND_DIR_1860CM	12.56	103.8	-999	None	None	Blank
SDEV_WIND_DIR_585CM	0	103.8	-999	None	None	Blank
SDEV_WIND_DIR_140CM	0	102	-999	None	None	Blank
SDEV_WIND_DIR_45CM	4.282	103.6	-999	None	None	Blank
VIRTUAL_HEAT_FLUX_ABV_CNPY	-123.4	541.6	-999	None	None	Blank
VIRTUAL_HEAT_FLUX_2806CM	-136.7	591.5	-999	None	None	Blank
VIRTUAL_HEAT_FLUX_1860CM	-463	189.6	-999	None	None	Blank
VIRTUAL_HEAT_FLUX_585CM	-62.86	309	-999	None	None	Blank
VIRTUAL_HEAT_FLUX_140CM	-34.33	125.8	-999	None	None	Blank
VIRTUAL_HEAT_FLUX_45CM	-5.095	20.47	-999	None	None	Blank
SDEV_SONIC_AIR_TEMP_ABV_CNPY	.02174	1.205	-999	None	None	Blank
SDEV_SONIC_AIR_TEMP_2806CM	.02662	.6554	-999	None	None	Blank
SDEV_SONIC_AIR_TEMP_585CM	.0199	1.103	-999	None	None	Blank
SDEV_SONIC_AIR_TEMP_45CM	.02266	1.11	-999	None	None	Blank
SDEV_VIRTUAL_TEMP_ABV_CNPY	.02175	1.205	-999	None	None	Blank
SDEV_VIRTUAL_TEMP_2806CM	.01903	1.218	-999	None	None	Blank
SDEV_VIRTUAL_TEMP_1860CM	.02229	1.468	-999	None	None	Blank
SDEV_VIRTUAL_TEMP_585CM	.01992	1.115	-999	None	None	Blank
SDEV_VIRTUAL_TEMP_140CM	.02565	1.247	-999	None	None	Blank
SDEV_VIRTUAL_TEMP_45CM	.02282	1.128	-999	None	None	Blank
LATENT_HEAT_STORAGE_ABV_CNPY	-120.6	87.57	-999	None	None	Blank
LATENT_HEAT_STORAGE_2806CM	-86.95	63.14	-999	None	None	Blank
LATENT_HEAT_STORAGE_1860CM	-26.03	31.08	-999	None	None	Blank
LATENT_HEAT_STORAGE_585CM	-18.01	13.56	-999	None	None	Blank
LATENT_HEAT_STORAGE_140CM	-3.553	4.34	-999	None	None	Blank
LATENT_HEAT_STORAGE_45CM	-1.024	1.043	-999	None	None	Blank

CO2_STORAGE_ABV_CNPY	-20.5590909	19.2477273	-999	None	None	Blank
CO2_STORAGE_2806CM	-16.7613636	16.7977273	-999	None	None	Blank
CO2_STORAGE_1860CM	-13.2181818	14.4681818	-999	None	None	Blank
CO2_STORAGE_585CM	-8.3	8.7568182	-999	None	None	Blank
CO2_STORAGE_140CM	-2.2772727	2.3159091	-999	None	None	Blank
CO2_STORAGE_45CM	-1.9327273	1.5211364	-999	None	None	Blank
WIND_SPEED_3940CM	.323	14.31	-999	None	None	None
WIND_DIR_3940CM	0	360	-999	None	None	None
AIR_TEMP_2830CM	-35.39	27.54	-999	None	None	None
AIR_TEMP_3730CM	-34.9	27.38	-999	None	None	None
REL_HUM_2830CM	6.259	94.99	-999	None	None	None
REL_HUM_3730CM	5.844	97.5	-999	None	None	None
SURF_PRESS	-999.9	96.57	None	None	None	None
DOWN_SHORTWAVE_RAD_ABV_CNPY	-3.617	993.5	-999	None	None	None
DOWN_PPFD_ABV_CNPY	-.5203	1871	-999	None	None	None
UP_PPFD_ABV_CNPY	-.1226	99.28	-999	None	None	None
SURF_TEMP_ABV_CNPY	-29.44	23.65	-999	None	None	None
HYGRO_DEW_POINT_3950CM	-39.9	17.46	-999	None	None	None
ABS_HUM_ABV_CNPY	.12	14.56	-999	None	None	None
OZONE_CONC_ABV_CNPY	3.177	60.29	-999	None	None	None
OZONE_CONC_BELOW_CNPY	.6754	52.81	-999	None	None	None
MEAN_AIR_TEMP_ABV_CNPY	-36.62	27.23	-999	None	None	Blank
MEAN_AIR_TEMP_3010CM	-36.14	27.12	-999	None	None	Blank
MEAN_AIR_TEMP_2540CM	-36.43	27.11	-999	None	None	Blank
MEAN_AIR_TEMP_2230CM	-36.73	27.3	-999	None	None	Blank
MEAN_AIR_TEMP_1920CM	-36.4	27.45	-999	None	None	Blank
MEAN_AIR_TEMP_1610CM	-36.36	27.27	-999	None	None	Blank
MEAN_AIR_TEMP_1300CM	-36.86	27.48	-999	None	None	Blank
MEAN_AIR_TEMP_990CM	-37.04	27.47	-999	None	None	Blank
MEAN_AIR_TEMP_680CM	-36.65	27.26	-999	None	None	Blank
MEAN_AIR_TEMP_230CM	-37.52	31.41	-999	None	None	Blank
MEAN_AIR_TEMP_80CM	-38.81	29.52	-999	None	None	Blank
SDEV_AIR_TEMP_ABV_CNPY	0	3.082	-999	None	None	Blank
SDEV_AIR_TEMP_3010CM	0	3.047	-999	None	None	Blank
SDEV_AIR_TEMP_2540CM	0	2.905	-999	None	None	Blank
SDEV_AIR_TEMP_2230CM	0	2.707	-999	None	None	Blank
SDEV_AIR_TEMP_1920CM	0	2.286	-999	None	None	Blank
SDEV_AIR_TEMP_1610CM	0	2.221	-999	None	None	Blank
SDEV_AIR_TEMP_1300CM	0	5.605	-999	None	None	Blank
SDEV_AIR_TEMP_990CM	0	2.192	-999	None	None	Blank
SDEV_AIR_TEMP_680CM	0	2.217	-999	None	None	Blank
SDEV_AIR_TEMP_230CM	0	2.135	-999	None	None	Blank
SDEV_AIR_TEMP_80CM	0	2.321	-999	None	None	Blank
TIP_BUCKET_PRECIP	0	10.8	-999	None	None	Blank
CO2_CONC_3460CM	323.9	411.3	-999	None	None	None
CO2_CONC_ABV_CNPY	323.9	411.3	-999	None	None	Blank
CO2_CONC_2540CM	323.5	436.7	-999	None	None	Blank
CO2_CONC_2230CM	322.6	442.1	-999	None	None	Blank
CO2_CONC_1920CM	322.8	446.9	-999	None	None	Blank

CO2_CONC_1610CM	323.1	455.1	-999	None	None	Blank
CO2_CONC_990CM	321.9	466.1	-999	None	None	Blank
CO2_CONC_230CM	324.3	644.1	-999	None	None	Blank
CO2_CONC_80CM	325.9	841.3	-999	None	None	Blank
HYGRO_VAPOR_PRESS_ABV_CNPY	.01794	.634	-999	None	None	Blank
HYGRO_VAPOR_PRESS_2540CM	.01592	.6372	-999	None	None	Blank
HYGRO_VAPOR_PRESS_2230CM	.01726	.6299	-999	None	None	Blank
HYGRO_VAPOR_PRESS_1920CM	.01613	.6326	-999	None	None	Blank
HYGRO_VAPOR_PRESS_1610CM	.01709	.6317	-999	None	None	Blank
HYGRO_VAPOR_PRESS_990CM	.01788	.6331	-999	None	None	Blank
HYGRO_VAPOR_PRESS_230CM	.01673	.678	-999	None	None	Blank
HYGRO_VAPOR_PRESS_80CM	.01509	.6368	-999	None	None	Blank
IRGA_VAPOR_PRESS_ABV_CNPY	.04481	.615	-999	None	None	Blank
IRGA_VAPOR_PRESS_2540CM	.04481	.6177	-999	None	None	Blank
IRGA_VAPOR_PRESS_2230CM	.04477	.6111	-999	None	None	Blank
IRGA_VAPOR_PRESS_1920CM	.04472	.6145	-999	None	None	Blank
IRGA_VAPOR_PRESS_1610CM	.04477	.6145	-999	None	None	Blank
IRGA_VAPOR_PRESS_990CM	.04472	.6159	-999	None	None	Blank
IRGA_VAPOR_PRESS_230CM	.04422	.6654	-999	None	None	Blank
IRGA_VAPOR_PRESS_80CM	.04305	.6213	-999	None	None	Blank
HYGRO_DEW_POINT_ABV_CNPY	-37.05	.45	-999	None	None	Blank
HYGRO_DEW_POINT_2540CM	-38.13	.52	-999	None	None	Blank
HYGRO_DEW_POINT_2230CM	-37.4	.36	-999	None	None	Blank
HYGRO_DEW_POINT_1920CM	-38.01	.42	-999	None	None	Blank
HYGRO_DEW_POINT_1610CM	-37.49	.4	-999	None	None	Blank
HYGRO_DEW_POINT_990CM	-37.08	.43	-999	None	None	Blank
HYGRO_DEW_POINT_230CM	-37.68	1.38	-999	None	None	Blank
HYGRO_DEW_POINT_80CM	-38.61	.51	-999	None	None	Blank
IRGA_DEW_POINT_ABV_CNPY	-28.45	.03	-999	None	None	Blank
IRGA_DEW_POINT_	-28.45	.09	-999	None	None	Blank

```
2540CM
IRGA_DEW_POINT_      -28.46         -.05           -999    None    None    Blank
2230CM
IRGA_DEW_POINT_      -28.47         .02            -999    None    None    Blank
1920CM
IRGA_DEW_POINT_      -28.46         .02            -999    None    None    Blank
1610CM
IRGA_DEW_POINT_990CM -28.47         .05            -999    None    None    Blank
IRGA_DEW_POINT_230CM -28.58         1.12           -999    None    None    Blank
IRGA_DEW_POINT_80CM  -28.84         .17            -999    None    None    Blank
CRTFCN_CODE          CPI            CPI            None    None    None    None
REVISION_DATE        09-AUG-99      31-AUG-99      None    None    None    None
-------------------------------------------------------------------------------
Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value  -- The value that indicates missing data. This is used to
                      indicate that an attempt was made to determine the
                      parameter value, but the attempt was unsuccessful.
Unrel Data Value   -- The value that indicates unreliable data.  This is used
                      to indicate an attempt was made to determine the
                      parameter value, but the value was deemed to be
                      unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the
                      instruments detection limits.  This is used to
                      indicate that an attempt was made to determine the
                      parameter value, but the analysis personnel determined
                      that the parameter value was below the detection
                      limit of the instrumentation.
Data Not Cllctd    -- This value indicates that no attempt was made to
                      determine the parameter value.  This usually
                      indicates that BORIS combined several similar but
                      not identical data sets into the same data base table
                      but this particular science team did not
                      measure that parameter.
Blank -- Indicates that blank spaces are used to denote that type of value.
N/A   -- Indicates that the value is not applicable to the respective column.
None  -- Indicates that no values of that sort were found in the column.
-------------------------------------------------------------------------------
```

7.4 Sample Data Record

The following are wrapped versions of data records from a sample data file on the CD-ROM.

TF02_DAILY_PRECIP

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,TIP_BUCKET_PRECIP,BELFORT_PRECIP,
STANDARD_PRECIP,CRTFCN_CODE,REVISION_DATE
'SSA-9OA-FLXTR','9TF02-DPR01',31-JAN-94,1500,-999.0,.4,-999.0,'CPI',03-AUG-99
'SSA-9OA-FLXTR','9TF02-DPR01',01-FEB-94,1500,-999.0,.8,-999.0,'CPI',03-AUG-99
```

TF02_TOWER_FLUX

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,NET_RAD_ABV_CNPY_1,NET_RAD_ABV_CNPY_2,
SENSIBLE_HEAT_FLUX_ABV_CNPY,SENSIBLE_HEAT_FLUX_2806CM,SENSIBLE_HEAT_FLUX_585CM,
SENSIBLE_HEAT_FLUX_45CM,LATENT_HEAT_FLUX_ABV_CNPY,LATENT_HEAT_FLUX_2806CM,
LATENT_HEAT_FLUX_585CM,LATENT_HEAT_FLUX_45CM,AIR_DENSITY_ABV_CNPY,
AIR_DENSITY_2806CM,AIR_DENSITY_1860CM,AIR_DENSITY_585CM,AIR_DENSITY_140CM,
AIR_DENSITY_45CM,WIND_SPEED_ABV_CNPY,WIND_SPEED_2806CM,WIND_SPEED_1860CM,
WIND_SPEED_585CM,WIND_SPEED_140CM,WIND_SPEED_45CM,FRICTION_VEL_ABV_CNPY,
FRICTION_VEL_2806CM,FRICTION_VEL_1860CM,FRICTION_VEL_585CM,FRICTION_VEL_140CM,
FRICTION_VEL_45CM,MOMENT_FLUX_ABV_CNPY,MOMENT_FLUX_2806CM,MOMENT_FLUX_1860CM,
MOMENT_FLUX_585CM,MOMENT_FLUX_140CM,MOMENT_FLUX_45CM,SDEV_W_WIND_SPEED_ABV_CNPY,
SDEV_W_WIND_SPEED_2806CM,SDEV_W_WIND_SPEED_1860CM,SDEV_W_WIND_SPEED_585CM,
SDEV_W_WIND_SPEED_140CM,SDEV_W_WIND_SPEED_45CM,H2O_FLUX_ABV_CNPY,H2O_FLUX_2806CM,
H2O_FLUX_585CM,H2O_FLUX_45CM,CO2_FLUX_ABV_CNPY,CO2_FLUX_2806CM,CO2_FLUX_585CM,
CO2_FLUX_45CM,STABILITY_INDEX_ABV_CNPY,STABILITY_INDEX_2806CM,
STABILITY_INDEX_1860CM,STABILITY_INDEX_585CM,STABILITY_INDEX_140CM,
STABILITY_INDEX_45CM,SDEV_WIND_DIR_ABV_CNPY,SDEV_WIND_DIR_2806CM,
SDEV_WIND_DIR_1860CM,SDEV_WIND_DIR_585CM,SDEV_WIND_DIR_140CM,SDEV_WIND_DIR_45CM,
VIRTUAL_HEAT_FLUX_ABV_CNPY,VIRTUAL_HEAT_FLUX_2806CM,VIRTUAL_HEAT_FLUX_1860CM,
VIRTUAL_HEAT_FLUX_585CM,VIRTUAL_HEAT_FLUX_140CM,VIRTUAL_HEAT_FLUX_45CM,
SDEV_SONIC_AIR_TEMP_ABV_CNPY,SDEV_SONIC_AIR_TEMP_2806CM,
SDEV_SONIC_AIR_TEMP_585CM,SDEV_SONIC_AIR_TEMP_45CM,SDEV_VIRTUAL_TEMP_ABV_CNPY,
SDEV_VIRTUAL_TEMP_2806CM,SDEV_VIRTUAL_TEMP_1860CM,SDEV_VIRTUAL_TEMP_585CM,
SDEV_VIRTUAL_TEMP_140CM,SDEV_VIRTUAL_TEMP_45CM,LATENT_HEAT_STORAGE_ABV_CNPY,
LATENT_HEAT_STORAGE_2806CM,LATENT_HEAT_STORAGE_1860CM,LATENT_HEAT_STORAGE_585CM,
LATENT_HEAT_STORAGE_140CM,LATENT_HEAT_STORAGE_45CM,CO2_STORAGE_ABV_CNPY,
CO2_STORAGE_2806CM,CO2_STORAGE_1860CM,CO2_STORAGE_585CM,CO2_STORAGE_140CM,
CO2_STORAGE_45CM,WIND_SPEED_3940CM,WIND_DIR_3940CM,AIR_TEMP_2830CM,
AIR_TEMP_3730CM,REL_HUM_2830CM,REL_HUM_3730CM,SURF_PRESS,
DOWN_SHORTWAVE_RAD_ABV_CNPY,DOWN_PPFD_ABV_CNPY,UP_PPFD_ABV_CNPY,
SURF_TEMP_ABV_CNPY,ABS_HUM_ABV_CNPY,OZONE_CONC_ABV_CNPY,OZONE_CONC_BELOW_CNPY,
MEAN_AIR_TEMP_ABV_CNPY,MEAN_AIR_TEMP_3010CM,MEAN_AIR_TEMP_2540CM,
MEAN_AIR_TEMP_2230CM,MEAN_AIR_TEMP_1920CM,MEAN_AIR_TEMP_1610CM,
MEAN_AIR_TEMP_1300CM,MEAN_AIR_TEMP_990CM,MEAN_AIR_TEMP_680CM,
MEAN_AIR_TEMP_230CM,MEAN_AIR_TEMP_80CM,SDEV_AIR_TEMP_ABV_CNPY,
SDEV_AIR_TEMP_3010CM,SDEV_AIR_TEMP_2540CM,SDEV_AIR_TEMP_2230CM,
SDEV_AIR_TEMP_1920CM,SDEV_AIR_TEMP_1610CM,SDEV_AIR_TEMP_1300CM,
SDEV_AIR_TEMP_990CM,SDEV_AIR_TEMP_680CM,SDEV_AIR_TEMP_230CM,SDEV_AIR_TEMP_80CM,
TIP_BUCKET_PRECIP,CO2_CONC_ABV_CNPY,CO2_CONC_3460CM,CO2_CONC_2540CM,
CO2_CONC_2230CM,CO2_CONC_1920CM,CO2_CONC_1610CM,CO2_CONC_990CM,CO2_CONC_230CM,
CO2_CONC_80CM,HYGRO_VAPOR_PRESS_ABV_CNPY,HYGRO_VAPOR_PRESS_2540CM,
HYGRO_VAPOR_PRESS_2230CM,HYGRO_VAPOR_PRESS_1920CM,HYGRO_VAPOR_PRESS_1610CM,
HYGRO_VAPOR_PRESS_990CM,HYGRO_VAPOR_PRESS_230CM,HYGRO_VAPOR_PRESS_80CM,
IRGA_VAPOR_PRESS_ABV_CNPY,IRGA_VAPOR_PRESS_2540CM,IRGA_VAPOR_PRESS_2230CM,
IRGA_VAPOR_PRESS_1920CM,IRGA_VAPOR_PRESS_1610CM,IRGA_VAPOR_PRESS_990CM,
IRGA_VAPOR_PRESS_230CM,IRGA_VAPOR_PRESS_80CM,HYGRO_DEW_POINT_ABV_CNPY,
HYGRO_DEW_POINT_3950CM,HYGRO_DEW_POINT_2540CM,HYGRO_DEW_POINT_2230CM,
HYGRO_DEW_POINT_1920CM,HYGRO_DEW_POINT_1610CM,HYGRO_DEW_POINT_990CM,
HYGRO_DEW_POINT_230CM,HYGRO_DEW_POINT_80CM,IRGA_DEW_POINT_ABV_CNPY,
IRGA_DEW_POINT_2540CM,IRGA_DEW_POINT_2230CM,IRGA_DEW_POINT_1920CM,
IRGA_DEW_POINT_1610CM,IRGA_DEW_POINT_990CM,IRGA_DEW_POINT_230CM,
IRGA_DEW_POINT_80CM,CRTFCN_CODE,REVISION_DATE
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31-AUG-99
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.09762,.04463,,-.1241,-.08699,,.00953,.001992,,.343,.2942,,.118,.04701,,1.4789,
-999.0,-999.0,,.1608,-999.0,-999.0,,-.2002,-.2616,,-1.339,.8526,,38.82,43.61,,
72.18,83.37,,25.87,33.6,,9.554,-.5821,,.1841,-999.0,-999.0,,.185,.2537,,.2025,
.2372,,14.3,11.19,,3.753,1.132,,.6713636,.7352273,,.5761364,.2120227,,1.531,
82.59,18.93,18.94,28.22,28.22,95.07,220.2,381.6,-999.0,15.03,4.73,40.53,32.34,
18.94,18.85,18.79,18.91,18.88,18.67,18.8,18.81,18.75,18.43,18.13,.15,.1209,.1287,
.1573,.1173,.1109,.1136,.1426,.1419,.1566,.1914,0.0,355.8,355.8,355.6,356.0,
355.7,355.7,358.3,364.0,378.4,,,,,,,,,,,,,,,,,.4999,,,,,,,,,,,,,,,'CPI',
31-AUG-99
```

8. Data Organization

8.1 Data Granularity

The smallest unit of data tracked by the BOREAS Information System (BORIS) was data collected at a given site on a given date.

8.2 Data Format

The Compact Disk-Read-Only Memory (CD-ROM) files contain American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

9. Data Manipulations

9.1 Formulae

9.1.1 Derivation Techniques and Algorithms

There are many equations and formulae used in the calculations of fluxes from the raw voltage signals. Readers are referred to the relevant references for details.

9.2 Data Processing Sequence

9.2.1 Processing Steps

Averages, variances, and covariances are calculated in real time, and coordinate rotation is applied on the half-hourly covariances and variances. Vapor pressure was calculated from dewpoint temperature using equations from Buck (1981).

BORIS staff processed these data by:

- Reviewing the initial data files and loading them online for BOREAS team access.
- Designing relational data base tables to inventory and store the data.
- Loading the data into the relational data base tables.
- Working with the team to document the data set.
- Extracting the data into logical files.

9.2.2 Processing Changes

Above-canopy dewpoint temperature was measured with the dewpoint hygrometer, except for the period 01-Jan to 01-Feb, when it was calculated from relative humidity and air temperature.

9.3 Calculations

9.3.1 Special Corrections/Adjustments

Sensible heat flux was derived from temperature from the sonic anemometer corrected for wind and humidity effects. Latent heat and water vapor fluxes were determined from the closed-path sensor with no density corrections applied. The CO_2 flux from the closed-path sensor included corrections for water vapor flux. The standard deviation of wind direction from the sonic anemometers was computed using the Yamartino algorithm. The virtual heat flux was calculated from the virtual temperature as measured by the sonic anemometer, and corrected for wind effects. The standard deviation of air temperature and virtual temperature from the sonic anemometer was corrected for wind and humidity effects.

The storage fluxes for latent heat and CO_2 were calculated from differences of water vapor profiles and CO_2 profiles, respectively, for the runs before and after the current run. The storage fluxes could be added to the latent heat flux or CO_2 flux. However, this assumes no horizontal advection below the measurement height. The validity of this assumption is difficult to evaluate, and obvious problems occur after frontal passages.

9.3.2 Calculated Variables

The above-canopy absolute humidity was calculated from air temperature and dewpoint temperature. Air density was computed from air temperature for air pressure = 94.5 kPa. The stability index was calculated using virtual temperature from the sonic anemometer.

9.4 Graphs and Plots

None.

10. Errors

10.1 Sources of Error

None given.

10.2 Quality Assessment

10.2.1 Data Validation by Source

Outliers were removed from the data.

The two net radiometers were intercompared. The comparison yielded NET_RAD_ABV_CNPY_2 = 1.111*NET_RAD_ABV_CNPY_1 for net radiation values greater than 0 and NET_RAD_ABV_CNPY_2 = 1.224*NET_RAD_ABV_CNPY_1 net radiation values less than 0. Net radiometer calibration was checked by TF-01 group against a precision pyranometer by shading on 11-Apr-1994 at 17:30 to 18:30 GMT; change in NET_RAD_ABV_CNPY_2 was 3.1% greater than for the standard.

10.2.2 Confidence Level/Accuracy Judgment

None given.

10.2.3 Measurement Error for Parameters

None given.

10.2.4 Additional Quality Assessments

The Belfort rain gauge tended to lag in registering precipitation events, and occasionally produced spurious readings. The standard rain gauge was probably the most reliable of the precipitation measurements.

10.2.5 Data Verification by Data Center

Data were examined to check for spikes, values that are four standard deviations from the mean, long periods of constant values, and missing data.

11. Notes

11.1 Limitations of the Data

None given.

11.2 Known Problems with the Data

None given.

11.3 Usage Guidance

None given.

11.4 Other Relevant Information

None.

12. Application of the Data Set

These data are useful for the study of water, energy, and carbon exchange in a mature aspen forest.

13. Future Modifications and Plans

Data collection from the SSA-OA tower continued after 1996. Contact Dr. T.A. Black for information about these data.

14. Software

14.1 Software Description

None given.

14.2 Software Access

None given.

15. Data Access

The SSA-OA tower flux, meteorological, and precipitation data are available from the Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

15.1 Contact Information

For BOREAS data and documentation please contact:

ORNL DAAC User Services
Oak Ridge National Laboratory
P.O. Box 2008 MS-6407
Oak Ridge, TN 37831-6407
Phone: (423) 241-3952
Fax: (423) 574-4665
E-mail: ornldaac@ornl.gov or ornl@eos.nasa.gov

15.2 Data Center Identification

Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics http://www-eosdis.ornl.gov/.

15.3 Procedures for Obtaining Data

Users may obtain data directly through the ORNL DAAC online search and order system [http://www-eosdis.ornl.gov/] and the anonymous FTP site [ftp://www-eosdis.ornl.gov/data/] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

15.4 Data Center Status/Plans

The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

16. Output Products and Availability

16.1 Tape Products

None.

16.2 Film Products

None.

16.3 Other Products

These data are available on the BOREAS CD-ROM series. Raw (20-Hz) data are available on CD-ROM by special request on a cost-recovery basis directly from the TF-02 team.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

None.

17.2 Journal Articles and Study Reports

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17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List Of Acronyms

```
AES      - Atmospheric Environment Service
AFM      - Airborne Fluxes and Meteorology
ASCII    - American Standard Code for Information Interchange
ATD      - Atmospheric Technology Division
ATI      - Applied Technologies, Inc.
BOREAS   - BOReal Ecosystem-Atmosphere Study
BORIS    - BOREAS Information System
CD-ROM   - Compact Disk-Read-Only Memory
DAAC     - Distributed Active Archive Center
EOS      - Earth Observing System
EOSDIS   - EOS Data and Information System
GIS      - Geographic Information System
GMT      - Greenwich Mean Time
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GSFC    - Goddard Space Flight Center
HTML    - Hyper-text Markup Language
i.d.    - inner diameter
IFC     - Intensive Field Campaign
IR      - Infrared
IRGA    - Infrared Gas Analyzer
LAI     - Leaf Area Index
NAD83   - North American Datum of 1983
NASA    - National Aeronautics and Space Administration
NEP     - Net Ecosystem Productivity
NSA     - Northern Study Area
OA      - Old Aspen
ORNL    - Oak Ridge National Laboratory
PANP    - Prince Albert National Park
PAR     - Photosynthetically Active Radiation
PC      - Personal Computer
PPFD    - Photosynthetic Photon Flux Density
SRC     - Saskatchewan Research Council
SSA     - Southern Study Area
TDR     - Time Domain Reflectometry
TF      - Tower Flux
UBC     - University of British Columbia
URL     - Uniform Resource Locator
WPL     - Webb, Pearman, and Leuning
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13. ABSTRACT *(Maximum 200 words)*

The BOREAS TF-2 team collected energy, carbon dioxide, water vapor, and momentum flux data above the canopy and in profiles through the canopy, along with meteorological data at the BOREAS SSA-OA site. Above-canopy measurements began in early February and ran through mid-September of 1994. Measurements were collected over a longer period of 1994 than most BOREAS flux sites. Daily precipitation data from several gauges were also collected. The data are available in tabular ASCII files.

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